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By H. C. GOUGH, Ph.D.

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WOLCOTT (G. N.). **Como combatir la polilla.** [What to do about Polilla.]—
Bol. Estac. exp. agric. Univ. P. Rico no. 68, 32 pp., 4 figs., 5 refs. Rio Piedras, 1946. **A List of Woods arranged according to their Resistance to the Attack of the West Indian Dry-wood Termite *Cryptotermes brevis* (Walker).**—*Caribb. Forester* 7 no. 4 pp. 329–336. Rio Piedras, 1946. (With a Translation in Spanish pp. 335–336 and a Summary in French.)

The first of these papers is intended for the guidance of residents in Porto Rico, where furniture and indoor woodwork, particularly that made of imported timber, is liable to damage by *Kalotermes (Cryptotermes) brevis*, Wlk. [cf. *R.A.E.*, A 27 464]. It contains a popular account of the habits of this termite and the characteristics that attract or repel it in wood [35 375], a list of woods arranged in groups according to their resistance to attack, based on one already noticed [29 157], and notes on the susceptibility of mixed woods and plywood. Information is given on proofing furniture made of susceptible woods by brushing the unpainted parts with suitable inorganic metallic compounds, of which a list is given with their appropriate dilutions, and instructions are included for mixing and applying copper sulphate and zinc chloride [32 30; 34 172], which are the most readily available of the effective materials. Impregnation with a 5 per cent. solution of DDT [cf. 34 344, etc.] or with pentachlorphenol [cf. 34 172] also gives lasting protection. If a house is to be constructed of timber, the latter should be impregnated with pentachlorphenol or one of the metallic salts before use. Termites already present can be destroyed by introducing small amounts of a solution of sodium arsenate (0.3 per cent. arsenic) or pentachlorphenol into the galleries through the holes that they make to eject their excreta. Some types of wood-pulp boarding have poisons or repellents incorporated in them, and one containing arsenic gave good results when used to reinforce houses of which the woodwork had been attacked.

The second paper comprises a revised list of local and imported woods arranged according to their resistance to the termite; *Syncarpia laurifolia* and *Amyris elemifera* are stated to be actually repellent.

MORANT (V.). **Migrations and Breeding of the Red Locust (*Nomadacris septemfasciata* Serville) in Africa, 1927–1945.**—*Anti-Locust Mem.* no. 2, 60 pp., 5 figs., 32 maps, 4½ pp. refs. London, 1947.

The major trends in the seasonal migration of *Nomadacris septemfasciata*, Serv., in Africa were studied from the numerous reports received at the Anti-Locust Research Centre during the recent outbreak, which began in 1927 and had practically come to an end by 1944. During this period, the locust ranged all over the continent south of the equator, except for parts of the southern and western coastal areas and the equatorial rain forest, and penetrated north of the equator into central Middle Congo and into a much larger area in the east including the extreme east of the Belgian Congo, the whole of Uganda except the north-east and of Kenya except the north, eastern and central Somalia and British Somaliland, and a narrow strip passing northwards along the Nile Valley into the Anglo-Egyptian Sudan. The topography and climate of the area under consideration, and the methods adopted in the analysis of the data are described.

N. septemfasciata passes through one generation a year and spends the greater part of its life as an immature adult. South of the equator, the swarms oviposit mainly in November–February, inclusive, the hoppers hatch during January–March, the swarms form during March–April, and the young adults migrate from about April until the end of July. A second migration by swarms of maturing and mature adults takes place from early October until January–February, when the old swarms disappear. The main areas in which breeding

took place during the 18 years of the outbreak and its frequency are shown on a map. It occurred most frequently (in 7-12 years) in the Lower Zambesi and Shire Valleys, in central Portuguese East Africa and south Nyasaland, respectively (termed the Zambesi focus), and in the Natal coastlands (Natal focus), though these are not where the outbreak began. It was found that the swarms of young adults formed in the Zambesi focus move northwards along the coastlands and the north-eastern plateaux (northern Mozambique, Tanganyika, Kenya, Uganda and Somalia), north-west across the north-east part of the central plateau (north-eastern Rhodesia and south-eastern Congo), westwards across the central plateau and western plateau edge (north-western Rhodesia and Angola) and south-west across the south-eastern part of the central plateau (central Mozambique and Southern Rhodesia) and that those formed at the Natal focus move north-west across the southern plateaux (Transvaal, Swaziland, Bechuanaland and South West Africa). At the same time, subsidiary movements take place within the east and west Rift Valleys and the Luangwa trough, at the northernmost limits of infestation, and throughout the southern plateaux and the extension of the central plateau in Southern Rhodesia. During the second migration, the swarms move from the west, north-west and south-west to the Zambesi focus and from the north-west and north to the Natal focus. There are also overflow movements from these foci along and parallel to the east coast, passing mainly northward from the Zambesi focus and southward from the Natal focus, and subsidiary movements to the eastern coastal plains. As a result of complex movements on the Tanganyika plateau and north-western plateau edge, swarms converge on the shores of Lake Victoria and the coast of north-west Angola, respectively. The swarms may mature and oviposit at any point where conditions are favourable during this migration and sometimes persist until April, although movements become less definite after March. During August-September, there is a transition period in which movements characteristic of each migration may take place in the same area. The south-easterly movement over the central and southern plateaux and the southward movement on the Natal coast begin about this period, but westerly movements continue over much of the central plateau in Angola and Northern and Southern Rhodesia, and the northerly movement in Kenya may continue into Somalia. In most areas, activity becomes more intense in September.

Breeding was not reported from British Somaliland, Somalia, the Gaboon and the Middle Congo, which were invaded only in 1935 [R.A.E., A 25 507], or from the Anglo-Egyptian Sudan, which was invaded only in 1937 [26 112]. There were three belts in the main invasion area in which it was extremely scattered and infrequent or did not occur at all. The largest of these extend southwards from north-eastern Angola and across north-eastern South West Africa and western Bechuanaland to the northern borders of Cape Province, and divides the main breeding area in the east from a western zone in which breeding is a little commoner though still scattered and infrequent. A second borders the western desert coast south of latitude 15°S., and the third extends obliquely south-eastwards from the eastern shore of Lake Tanganyika to the northern Quelimane district of Mozambique. Gregarious hoppers were recorded in 11-12 years in the south of southern Nyasaland, in 7-10 over southern Nyasaland as far north as the southern shores of Lake Nyasa and down the Lower Zambesi, and in 5-10 in the north-eastern districts of Southern Rhodesia and the eastern coastlands of Natal; in general, they were recorded in only 1-4 seasons elsewhere. The seasonal hopper infestation in 16 unit areas was correlated with rainfall by means of histograms in which the total number of records received throughout the period for each individual calendar month is shown as a percentage of the total number of records for all months. There is one rainy season a year over the greater part of the area, and in general most of

the rain falls in April–September north of the equator and in October–March south of it. Hopper development is restricted to the rainy season, and infestation by hoppers is heaviest in the main area of infestation from November or December to May, notably in January and February. It continues from December or January till July in northern Tanganyika and southern Kenya, with a peak in February–March in the former and April–May in the latter, and occurs during July–October in the Lake Chad area, with a peak in August–September. In the equatorial and Ruwenzori areas, where conditions are humid throughout the year, hopper infestation is also continuous, with peaks in July–August and November–December in the former and one in December in the latter; in the equatorial region, the period of least infestation coincided with that of heaviest rainfall (February–June).

An account is given of the course of the outbreak. It reached its peak early, in 1933–34, and then declined slowly. The direction of the movements during any particular year did not deviate notably from the generalised scheme, but the relative importance of the main trends differed from generation to generation. Outside the main invasion area, the locust was reported from Lake Chad in 1930–34, but bred there only in 1930–32. In view of the great distance from the main area, it is concluded that the Lake Chad swamps probably provide a permanent habitat, but that conditions there are less favourable for rapid multiplication than the Mweru and Rukwa outbreak areas, where the outbreak originated [35 164]. Individual adults of phase *solitaria* were observed in the swampy regions of the Niger Bend in January 1933, March 1938, and June, July and September 1942 [cf. 27 570].

A graphical analysis of the outbreak is given by D. E. Davis (pp. 37–40), who shows by this means that in general the spread of the swarms was directly correlated with their numbers and that the sixth-generation swarms were the most successful in breeding, since the hoppers to which they gave rise infested 78 per cent. of the area covered by the parent swarms. The area infested by hoppers was greatest during the seventh–ninth generations, and the swarms of the eighth generation were the most widely distributed, but the percentage relation between the area occupied by them and their progeny fell to 37·1. The average percentage relation was 23·9. The greatest percentage rate of increase in the area infested occurred between the swarms of the third and fourth generations and the hoppers of the fourth and fifth, although the peak of the outbreak was not reached until the eighth generation of swarms and ninth of hoppers. After this generation of hoppers, a slow and gradual decline set in, which was evidently brought about by factors unfavourable to both adults and hoppers, since the rate of decrease in swarm records and in the areas infested by swarms and hoppers was uniform. The spread of swarms from the areas in which they originated was also greatest in the fourth generation and fell sharply during the next four generations. Hoppers of the ninth generation occupied the largest absolute area, but the area covered by the swarms to which they gave rise was only slightly larger, evidently because many of the hoppers were not able to complete their development. Parasites, a fungus disease [25 507] and abnormal drought were all reported, and it is assumed that the great dispersal in the eighth generation brought the locusts into areas that were unfavourable to them and that this initiated the decline of the outbreak.

PETTEY (F. W.). **Biological Control of Prickly Pear.**—*Fmg in S. Afr.* 1946
repr. no. 6, 3 pp. Pretoria, 1946.

The amount of success obtained in attempts made to control prickly-pear [*Opuntia*] in the infested areas of the eastern section of Cape Province by the introduction, mass rearing and liberation of [*Cactoblastis cactorum*, Berg, *Dactylopius opuntiae*, Ckll., and *Lagocheirus funestus*, Thoms.], is briefly reviewed.

C. cactorum is of less value than at first seemed likely [cf. *R.A.E.*, A 32 14, 397], but is able, with *D. opuntiae*, to destroy young seedlings and prevent them from becoming established in new territory. *D. opuntiae* at first caused considerable defoliation in areas not less than 40 miles from the coast other than cold, exposed mountain slopes and places with limited winter sunshine, but its destruction by Coccinellids [32 397] and, more recently in areas other than the Karroo, by a fungus of the genus *Empusa*, now frequently prevents this. In coastal areas, these natural enemies have prevented defoliation since the third year after the Coccid became established. Felling to assist the work of *C. cactorum* and *D. opuntiae* has given very good results [32 397]. The larvae of *L. funestus* [cf. 29 18] tunnel in the woody segments of prickly pear, causing the branches to collapse, but do not infest the leaf-pads. In all, 325,750 adults of this Lamiid were reared in 1942-45, and 287,628 were liberated in seven districts. Although it has produced three generations in the field, its numbers have decreased everywhere, despite supplementary releases. Its lack of success is attributed to the excessive secretion of mucilage produced in the furrows made in the bark for the reception of the eggs, which, on hardening, kills many of the eggs and young larvae, the failure of the beetles to oviposit in the absence of rain (oviposition is poorer in winter than in summer), and the destruction of the adults by ants, lizards and spiders and of the cocoons by rodents.

ULLYETT (G. C.). *Red Scale on Citrus and its Control by natural Factors.*—
Fmg in *S. Afr.* 1946 repr. no. 25, 5 pp. Pretoria, 1946.

Since natural factors have recently been found to give effective control of the red scale [*Aonidiella aurantii*, Mask.] in *Citrus* orchards in various parts of South Africa, keeping the scale population as low as that normally found in orchards receiving a regular and thorough annual fumigation [cf. also *R.A.E.*, A 31 220], investigations were carried out on its natural enemies [cf. 26 456] in the hope that natural control could be extended to cover a larger proportion of the *Citrus* areas of the Union.

It was found that parasites, predators, disease and such factors as tree condition and weather were very closely interrelated in their effect on *A. aurantii*. Parasites, of which six are known in South Africa, and predators, including Coccinellids, Syrphids and mites, were both of importance, though neither would be effective alone, and weather had both a direct effect on the scale and an effect on the incidence of disease. Tree condition, which varies with the food and water available and the cultural treatment, has considerable effect on the Coccid, which prefers healthy, young and vigorous trees. Natural and chemical control are usually incompatible, as, if the trees are fumigated, particularly in summer, when the natural enemies are active and reproducing, parasites and predators are killed with the Coccids and the complex of natural control factors does not function as a whole. In order that natural control may become established in an orchard, the presence of a moderate population of Coccids, on which large populations of parasites and predators can develop, is necessary, and control measures must therefore be stopped, in order to encourage a minor outbreak of *A. aurantii*. This will involve a loss of exportable fruit during the period of establishment, but it has been observed that orchards that have been left untreated for two years, irrespective of the scale population, have not needed fumigation afterwards. Some of them have remained under natural control for 4-6 years.

The author points out that it is possible that satisfactory biological control may never be attained in some localities, though this seems unlikely, and that it may not be equally effective every year. Its establishment and maintenance are not so simple as chemical control and require the guidance of a competent entomologist.

MILES (H. W.) & MILES (M.). **Insect Pests of Glasshouse Crops.**—2nd edn. revd., $8\frac{3}{4} \times 5\frac{3}{4}$ ins., 200 pp., 24 pls., 12 figs., 5 pp. refs. London, Crosby Lockwood & Son, Ltd., 1948. Price 15s.

This second edition of a manual on insect and other invertebrate pests of glasshouse crops in England and on their control is similar in scope to the first [R.A.E., A 23 706], but a few additional pests are included, and the information on control is extended to cover some recently developed insecticides.

MILES (M.). **Field Observations on the Bean Seed Fly (Seed Corn Maggot), *Chortophila cilicrura*, Rond., and *C. trichodactyla*, Rond.**—*Bull. ent. Res.* **38** pt. 4 pp. 559–574, 4 figs., 28 refs. London, 1948.

In view of the damage to germinating beans by bean seed flies each year in south Worcestershire, investigations were made on their bionomics to obtain information on which control measures could be based. It was found that two species were involved, *Hylemyia (Chortophila) cilicrura*, Rond., and *H. (C.) trichodactyla*, Rond., of which the former appeared to be the more numerous, and both species were also bred from leeks and spring cabbage. All stages are described, but the two species can be distinguished only by characters of the adult males and for that reason are treated as one.

The larvae attacked the bean seed as soon as the testa split, and showed no preference for diseased seeds. The feeding of less than three larvae in healthy cotyledons did not perceptibly affect growth, but infestation by several depleted the food reserves of the seedlings. Injury to the embryonic region prevented germination, and seedlings were killed or greatly weakened when attack by maggots aided the spread of fungi and bacteria in the cotyledons. Peas were less commonly attacked, probably because they were usually sown before the spring generation was active, but larvae sometimes fed in the cotyledons and shoots. In October 1945, the maggots were found to be widely distributed at the roots of newly planted spring cabbage. The crop showed no signs of attack during the autumn, but contained a large number of bolted plants and some with soft rot in spring, and this condition may have been related to insect attack. The larvae were also found with those of *H. (C.) brassicae*, Bch., at the roots of cauliflower, summer cabbage, brussels sprouts and kale at various places during spring and summer, but constituted less than 10 per cent. of the root-maggot population. Leeks set out in June and July were attacked in July, and the larvae were widely distributed in the two fields under observation. *H. antiqua*, Mg., was the dominant species in onions, but bean seed flies were also bred from them, and they were found tunnelling in the hypocotyls of seedling cucumbers growing out of doors in June 1946; one larva was found in the root of a lettuce in December 1944, when the crop was being severely attacked by larvae of *Helophorus* sp.

The bionomics and control of the flies are discussed from the literature, and field observations throughout the year are described in detail. The flies were taken on the wing in every month from March to October, and there was some evidence of slight activity during the winter; the larvae were active from May to December. There appeared to be 3–4 generations a year. Adults of the overwintering generation were active from mid-April to mid-May, larvae of the first generation fed in germinating seeds of beans and cucumbers and at the roots of summer cauliflower during late May and early June, and adults of this generation were on the wing in the second half of June and early July, when they were taken on beans, crucifers, leeks, carrots and headland herbage. Second-generation larvae were found at the roots of crucifers and leeks in July, and adults were present during the first half of August. Larvae of the third generation fed at the roots of transplanted spring cabbage and those of the fourth at the roots of late-transplanted spring cabbage and lettuce. Adults of

the third generation were on the wing from mid-September to mid-October, but there seems to be some overlapping of generations, particularly in autumn, and the flies were sometimes numerous in sunny weather from August to October and larvae at a peak of activity over the same period. It appeared that there was no direct association with rotting vegetation, and that the main infestations occurred in market gardens that were cultivated during periods of fly activity. In the Evesham area, there is a succession of short-term crops with extensive areas of bare soil between the rows and almost continuous surface cultivation to keep down weeds and conserve moisture, so that conditions are favourable for the ovipositing flies and their larvae throughout the season. Irrigation keeps the soil attractive for long periods after cultivation and provides adequate moisture for the larvae until they reach food. It also masks the signs of insect attack on crops and enables them to support higher populations of injurious insects. The sunny sheltered situations that are favourable for intensive vegetable culture also favour fly activity. The flies appeared to be less numerous on heavy than on light soils.

The parasites observed in south Worcestershire were the Staphylinid, *Aleochara bipustulata*, L., and the Cynipid, *Trybliographa diaphana*, Htg. Predaceous maggots were found in infested beans, and *Coenosia tigrina*, F., was reared.

In a preliminary field experiment, dusting with naphthalene at the rate of 56 lb. per acre immediately after the seed bed was prepared and again immediately after the ground was harrowed after sowing gave a small increase in the number of healthy bean plants, but it was not significant. Other possible methods of preventing infestation are discussed, and it is suggested that the preparation of bean seed beds in March would render them less attractive to ovipositing flies in mid-April. Marking the rows should be carried out so as to disturb only dry surface tilth, and harrowing should be delayed until the beans are through the ground or should be followed immediately by the use of a repellent such as naphthalene. Dipping the roots of spring cabbage in a paste of mercurous chloride (calomel) and water before transplanting should protect them from attack by the autumn generation; dusting with mercurous chloride round the collars of newly set plants is not likely to be effective, as the eggs are not always laid near the food-plants and the soil may be infested before the plants are set out.

DRESDEN (D.) & KRIJGSMAN (B. J.). **Experiments on the physiological Action of Contact Insecticides.**—*Bull. ent. Res.* **38** pt. 4 pp. 575-578, 12 refs. London, 1948.

The main object of this paper is to show that the powerful action of DDT, the γ isomer of benzene hexachloride (hexachlorcyclohexane) and rotenone as contact insecticides and their greater toxicity to insects than to vertebrates when applied externally is due, not to their having a specific action on the internal tissues of insects, but merely to their being more readily absorbed through the cuticle of insects. The results are given of a number of tests by the authors and others in which the median lethal doses of all three insecticides to insects and a frog (*Rana esculenta*) and of DDT and γ benzene hexachloride to mammals were determined when the poisons were applied on the skin or by intravenous, intra-abdominal or subcutaneous injection. They are summarised in a table in which the respective median lethal doses of DDT, γ benzene hexachloride and rotenone in mg. per kg. body weight are given as 300-3,000, 300-500 and very high when applied on the skin of vertebrates, 12-75, $<50-75$ and 0.35-2 when injected intra-abdominally or intravenously into vertebrates, 5-30, 0.4-7.5 and about 30 when applied on the skin of insects, and 5-60, 3-17 and 6-15 when injected intra-abdominally into insects. It

appears, therefore, that the toxicity of DDT, γ benzene hexachloride and rotenone are of the same order for vertebrates and insects, rotenone being possibly a little more toxic to vertebrates than to insects. They display the same activity in insects when applied to the skin as after injection, but are much less toxic to vertebrates on the skin, showing their high ability to penetrate the insect cuticle. No poison has been found to possess a specific toxicity to the physiological processes of insects, whereas the median lethal dose of injected strychnine was 0.2-10 mg. per kg. for vertebrates and 500 for insects. Research on new contact insecticides should therefore be directed to their power of penetration through the chitinous cuticle, a high solubility in lipoids being necessary and a specific adsorption by chitin favourable. The difference in toxicity of γ benzene hexachloride and DDT when applied to the skin is obviously also based on the higher rate of penetration of the former.

To determine whether the lower insecticidal value of the α , β and δ isomers of benzene hexachloride is due to low toxicity or to low ability to penetrate the cuticle, emulsified solutions of the pure isomers were injected into cockroaches (*Periplaneta americana*, L.). The median lethal dose of the γ isomer appeared to be 17 mg. per kg. body weight, but doses of 85 mg. α , β , or δ isomer per kg., the highest that could be obtained, had no effect, showing that their inactivity was due to low toxicity.

In view of the suggestion that γ benzene hexachloride acts by competing with meta-inositol in cell metabolism in insects [R.A.E., A 33 257], 17 mg. per kg. of this isomer in an emulsified solution, the same amount of meta-inositol or both simultaneously were injected into cockroaches to determine whether the simultaneous application of both substances reduced the toxicity of the γ benzene hexachloride. Mortality was low in the group receiving inositol only and 50 per cent. in the other two groups, and it was again 50 per cent. when 17 mg. γ benzene hexachloride and 34 mg. meta-inositol per kg. were injected simultaneously, indicating that the mortality caused by γ benzene hexachloride is probably not due to its similarity to meta-inositol.

KLEIN (H. Z.). Notes on the Green Leafhopper, *Empoasca lybica*, Berg. (Hom. Jassid.) in Palestine.—*Bull. ent. Res.* 38 pt. 4 pp. 579-584, 7 refs. London, 1948.

Investigations on the life-history of *Empoasca lybica*, Berg., of which *Chlorita signata*, Haupt [cf. R.A.E., A 18 105] is considered a synonym, were made in Palestine in 1942-45 by keeping the leafhoppers on egg-plant [*Solanum melongena*] in field cages. The adults paired 1-2 days after the last moult in the hot season, and females isolated after their first mating laid as many eggs as those that paired several times. Parthenogenetic reproduction was not observed. The preoviposition period varied from 2-3 days in summer to three weeks or more in winter. The average and maximum daily numbers of eggs laid per female were 1-3 and 7, and the average and maximum total numbers that hatched were 16 and 81. They were deposited in the leaf tissue, especially in the main veins of the under side, and hatched in 5-15 days in summer, 9-22 in spring and 20-44 in winter. The nymphal stage lasted 8-50 days, according to the season, the life-cycle varied from 15 days in summer to 72 in winter, and there were about eight generations in the year. The threshold of development was 10-12°C. [50-53.6°F.] for all stages, and the rate of development depended on temperature, air humidity having no influence on either eggs or nymphs. Both died in large numbers in the cold winter months and in the heat of August, and no eggs were laid and many nymphs, particularly in the early stages, died when there was a dry east wind. The adults were most active in hot weather and ceased moving at temperatures below 14°C. [57.2°F.]. Temperatures above 15°C. [59°F.] were necessary for oviposition, and a temperature above

46°C. [114.8°F.] in test-tubes caused immediate death. The adults lived for up to seven weeks in summer and up to five months in the overwintering generation, with no marked difference between males and females. These occurred in approximately equal numbers.

In Palestine, *E. lybica* is particularly injurious to egg-plant, tomato, pepper [*Capsicum*] and potato and also occurs on beet, radish, sweet potato and various pulses and cucurbits. It is not known whether the green leafhoppers on grape vine and castor [*Ricinus communis*] belong to this species. It also infests various wild plants, which may be important as winter food-plants. Both nymphs and adults feed on the underside of the leaves, causing staining and curling of the edges; the plants are delayed in development and shed flowers and small fruits. *E. lybica* is very injurious in summer and autumn, but decreases in numbers at the beginning of the rainy season. Serious damage is sometimes caused to young egg-plants between mid-June and mid-August, and it is then useless to continue the cultivation of the plants, but large ones, planted in May and early June, are not much injured. On tomato, the feeding of the Jassid causes light streaks on the stems, which become brittle.

Attempts to control *E. lybica* with rotenone, nicotine, whale-oil soap, Bordeaux mixture and sulphur were not successful, even when the treatment was repeated several times during the season.

MUNRO (H. K.). **The Status of *Dacus armatus* Fabricius and of *Dacus bivittatus* (Bigot) (Trypetidae, Diptera).**—*Bull. ent. Res.* **38** pt. 4 pp. 613-622, 9 figs. London, 1948.

In view of the economic importance of *Dacus bivittatus*, Big., and the confusion of this species with *D. armatus*, F., the author discusses the identity and synonymy of both. He considers *D. lulongaensis*, Collart, to be a subspecies of *D. armatus*, and *D. cucumarius*, Sack, of *D. bivittatus*, although Silvestri's reference to *D. cucumarius* [R.A.E., A 1 388] applies to *D. b. bivittatus* and some references to *D. bivittatus* [cf. **4** 454] apply to *D. b. cucumarius*. *D. bipartitus*, Graham [cf. **2** 672; **3** 433] is considered a synonym of *D. b. bivittatus*. Walker described two species as *D. pectoralis*, one oriental and one from Africa, the oriental species having priority. The African *D. pectoralis* [cf. **13** 1; **14** 200; **23** 182, 690; **26** 492] is identical with *D. b. cucumarius*. A key is given distinguishing *D. a. armatus*, *D. a. lulongaensis*, *D. b. bivittatus*, *D. b. cucumarius* and *D. b. cucumarius* form *atrescens*, n. (a melanic form from Kenya and the Belgian Congo) and the adults of both sexes are described.

D. armatus appears to be rare; only one female of the typical subspecies from southern Nigeria [**3** 748] and two males from the Gold Coast have been identified since it was originally described from Guinea, and only the type male of *D. a. lulongaensis* from the Belgian Congo and one male and one female from Nyasaland are recorded. *D. b. bivittatus* has been recorded in Sierra Leone, Liberia, Ashanti, the Gold Coast, Nigeria, the Cameroons and the Island of Principe, on cucumber and other cultivated cucurbits and also on *Cucumis* and *Momordica*, which are presumably wild food-plants; and *D. b. cucumarius* on cucurbits in South Africa, Southern Rhodesia, Tanganyika, Nyasaland, Uganda, Kenya and Zanzibar, tomato and papaya in South Africa, tomato and *Vitex* sp. in Uganda, and granadilla (*Passiflora quadrangularis*) and *Dioscorea macroura* in Tanganyika, and also, without host-fruit records, in Portuguese East Africa, the Belgian Congo and Eritrea.

D. bivittatus is present throughout the year in the more tropical regions of Africa. It attacks fruit at any stage of its growth and larvae (of subsp. *cucumarius*) have been found in South Africa in the flowers of *Sphaerosicyos sphaericus* [cf. also **23** 690]. The development period may last 1-2 months, and there are probably 2-3 generations a year under favourable conditions, but

possibly only one if there is not abundant food. The adults probably live for some time, overwintering if necessary: they feed on honeydew and other sweet exudations. This Trypetid does not appear to be much attacked by parasites, only *Tetrastichus giffardi*, Silv., from puparia of subsp. *bivittatus* in the Cameroons and *Spalangia afra*, Silv., and a species of *Dirhinus* from subsp. *cucumarius* in Zanzibar having been recorded [1 388; 26 492].

LEPESME (P.) & others. **Les insectes des palmiers.**—9 $\frac{3}{4}$ × 6 $\frac{1}{4}$ ins., [4+] 903 pp., 638 figs., 31 pp. refs. Paris, P. Lechevalier, 1947. Price Fr. 3,200.

This comprehensive work on the insects associated with palms throughout the world is arranged in three sections. The first, by P. Lepesme and R. Paulian (pp. 13–134), comprises a discussion of the inter-relationships between palms and insects. The second (pp. 135–708), which is divided into sections by various authors, contains systematic lists of insects and other arthropods associated with palms, with notes on their morphology, habits and distribution, the principal references to them in the literature and keys to some of the insects. The third, by Lepesme (pp. 709–778), deals with the control of insects that attack palms of economic importance or their products. Information on the influence of birds and mammals on palm insects and the utilisation of palm insects as human food and notes on flies of different feeding habits that occur on or in the neighbourhood of palms are given in appendices.

SONAN (J.). **Three new Species of parasitic Hymenoptera from Formosa.**—*Trans. nat. Hist. Soc. Formosa* **32** no. 224 pp. 217–220. Taihoku, 1942.

The new species described are *Apanteles gracilariae* [a pre-occupied name (cf. R.A.E., A **28** 501)], reared from larvae of *Gracilaria theivora*, Wlsm., *A. theae*, from *Homona coffearia*, Nietn., and *Euplectrus taiwanus*, from larvae of *Euproctis (Porthesia) taiwana*, Shir., *Spodoptera mauritia*, Boisd., and *Bombotelia jocosatrix*, Gn.

SONAN (J.). **Two new Species of *Apanteles* from Formosa (Hym. Braconidae).**—*Trans. nat. Hist. Soc. Formosa* **32** no. 225 pp. 245–246. Taihoku, 1942.

Descriptions are given of *Apanteles heichinensis*, sp. n., reared from *Homona coffearia*, Nietn., and *A. taiwanensis*, sp. n., reared from cocoons of *Euproctis (Porthesia) taiwana*, Shir.

HELSON (G. A. H.). **A Survey of Insect Pests and Details of Insecticide Trials on Army Farms in the Northern Territory.**—*J. Coun. sci. industr. Res. Aust.* **20** no. 1 pp. 9–16, 4 refs. Melbourne, 1947.

Farms were developed in the Northern Territory during 1940–44 to supply army needs, and since insect pests, especially species introduced on fruit and vegetables brought into the area, gradually became troublesome and many of the crops were being cultivated on a large scale for the first time in this region, a survey of the pests present was made in July 1945, at the height of the growing season. Lists are given of upwards of 20 insects found on farms in three areas and the crops they attacked, with notes on a few other species observed. Those specifically identified were *Agromyza phaseoli*, Coq., on beans, *Hyenia recurvalis*, F., and *Hellula undalis*, F., on beet, *H. undalis*, *Heliothis armigera*, Hb., and *Plutella maculipennis*, Curt., on cabbage, *Aonidiella aurantii*, Mask., *Saissetia oleae*, Bern., and *Lepidosaphes beckii*, Newm., on *Citrus*, *Epilachna vigintioctopunctata*, F., *Aulacophora (Ceratia) hilaris*, Boisd., *A. (Raphidopalpa) palmerstoni*, Blkb., *Orosius argentatus*, Evans, *Aphis gossypii*, Glov., and *Thrips tabaci*, Lind., on cucurbits, *O. argentatus* on lettuce, *H. armigera* and *Aphis*

maidis, Fitch, on sweet maize, *Gnorimoschema operculella*, Zell., on potato, *G. operculella*, *H. armigera*, *T. tabaci*, *O. argentatus* and *Heliothrips haemorrhoidalis*, Bch., on tobacco, and *Heliothis armigera* and *T. tabaci* on tomato.

In consequence of the rapid growth of vegetables under tropical conditions and the large areas involved, more effective insecticides than those available and a rapid means of applying them over large areas were required. A power orchard spraying machine adapted to take a six-row crop spray boom to which 18 cyclone, hollow-cone nozzles were so attached that there were three nozzles to each row, two directed horizontally and slightly upwards and one vertically downwards, gave very efficient coverage. Two of these machines were used to treat the tomato and cabbage crops on the farms in 1945 and were so effective that power dusters were not obtained; such dusts as were required were applied with a knapsack duster. Field tests were made with sprays consisting of emulsified solutions of DDT in solvent naphtha and dusts of DDT, crude benzene hexachloride or synthetic cryolite in "pyrophyllite" [cf. *R.A.E.*, A 34 231]. When dusts containing 1 or 2 per cent. benzene hexachloride, 0.5 or 1 per cent. DDT or 40 per cent. synthetic cryolite were applied to cabbage at a rate of 35 lb. per acre four times at intervals of ten days, beginning on 14th August, and the plants were examined on 30th September, all the treatments were effective against *Hellula undalis*, with no significant difference between them. Dusts containing 1 and 2 per cent. DDT or 50 per cent. synthetic cryolite and sprays containing 0.1 or 0.2 per cent. DDT were tested against *Heliothis armigera* on tomatoes. The rates employed were about 35 lb. dust and 80-100 gals. spray per acre, and treatments were applied four times at intervals of ten days, beginning on 31st August. The mean percentages of fruits damaged on treated plants varied from 0 to 1.3 at the first harvest, on 3rd October, and from 0 to 1.5 at the second, in mid-November, as compared with 13.6 and 12.6, respectively, in the controls.

A crop of cabbages at one of the farms was heavily infested by *H. armigera*, *Hellula undalis* and *Plutella maculipennis*, but was saved by an application of the 2 per cent. DDT dust in July, followed by one of the 0.1 per cent. DDT spray in August.

HELSON (G. A. H.). **Investigations on the Control of Oriental Peach Moth, *Cydia molesta* Busck, in the Goulburn Valley, Victoria.**—*J. Coun. sci. indusir. Res. Aust.* 20 no. 1 pp. 17-24, 1 fig., 3 refs. Melbourne, 1947.

An account is given of the attempts made between 1935 and 1941 to establish six introduced parasites of *Cydia molesta*, Busck, on peach in the Goulburn Valley, much of which has already been noticed [*R.A.E.*, A 31 44, etc.]. In a discussion of the work, it is stated that 14,195 parasites were liberated in all. Of these, 11,726 were *Macrocentrus ancylivorus*, Rohw., and 964 examples of this species, which was the only one that showed any promise, were recovered. Only four examples were bred from overwintering cocoons, but a few first-generation individuals were recovered in the field in 1939, twelve months after the last liberation at that site [30 101]. No evidence of the presence of any introduced parasite was obtained after 1941, when liberations ceased. Since the percentage infestation in peaches brought to canning factories during 1935-41 varied from four to 50 and was about 20 in the years when most parasites were released, the failure of the parasites cannot be attributed to lack of host larvae. Observations over three years showed that the long warm autumns caused many adults of *M. ancylivorus* to emerge in May and June, when no hosts were available, and that there was also high mortality, among overwintering parasites. Alternative autumn hosts, such as *Ancylis comptana*, Froel., which greatly assists *M. ancylivorus* to overwinter in the United States, do not occur in Victoria.

In view of the failure of the parasites to control *C. molesta*, experiments with sprays containing 0.1 per cent. DDT were carried out in 1945 [35 159] and 1946. In the latter year, DDT was used in the form of Rucide, two late (February) applications were again made, and the percentage infestation of the fruit was reduced from 9 to 2.75. It is stated in a paper noticed elsewhere [B 36 101] that Rucide is a proprietary paste that contains 50 per cent. p,p' DDT by weight and a "solubiliser". It is melted until a clear liquid is formed at a temperature of over 100°C. [212°F.], and the liquid is then stirred into soft water, a suspension of fine particles of DDT resulting.

STEPHENS (R. M.). **Codling Moth Control. D.D.T. Trials in Victoria 1946-1947.**—
J. Dep. Agric. Vict. 45 pt. 10 pp. 468-470. Melbourne, 1947.

Tests of DDT against the codling moth [*Cydia pomonella*, L.] on apple and pear in Victoria [R.A.E., A 35 368] were continued in 1946-47. In the major experiment, at Ardmona, Williams' pear trees that had received a delayed dormant spray of 4 per cent. oil were sprayed with emulsions containing 0.1, 0.05 and 0.025 per cent. DDT, prepared from a commercial emulsion concentrate containing 20 per cent. DDT, or a 0.1 per cent. suspension of DDT, prepared by melting a solid product containing 50 per cent. DDT and mixing it with water. The 0.1 per cent. emulsion was further applied combined or alternated with white oil (1 : 80), while the controls received a calyx spray of 5 lb. lead arsenate paste in 80 gals. water and three cover sprays of the same with 4 pints white oil per 80 gals. When the DDT was applied in a calyx and three cover sprays timed by bait catches, as was the lead arsenate, the percentages of fruits damaged were 0.7, 1.3 and 7.5 for the 0.1, 0.05 and 0.025 per cent. emulsions, respectively, and 0.7 for the 0.1 per cent. suspension, as compared with 1.4 for lead arsenate; 0.05 per cent. DDT was not significantly inferior to 0.1 per cent., but was significantly better than 0.025 per cent. The percentage of damaged fruits for the 0.1 per cent. emulsion rose to 1.3 when the intervals between the four applications were fixed at 1, 2 and 3 weeks, respectively, but fell to 0.5 when all intervals were one month, and remained unaltered when three cover sprays of DDT followed a calyx spray of lead arsenate. It rose to 1.1 when only two cover sprays of DDT were applied and was 0.4 and 4 when DDT was combined or alternated with white oil, which scorched the foliage but did not damage the fruit. The DDT suspension caused black rings on the fruit, which may be associated with the use of technical DDT.

In a test of a calyx and three cover sprays, timed by bait catches, on pear trees at Shepparton East, the percentages of damaged fruits were 0.4 for the 0.1 per cent. DDT emulsion and 10.1 for the lead arsenate schedule, the difference being highly significant. There was no physical difference between trees sprayed with DDT and unsprayed ones, but both were brighter in colour than those sprayed with lead arsenate.

In a test on Jonathan apples at Blackburn, the percentages of fruits damaged were 3.2, 2 and 1.1 for a calyx and two, three or four cover sprays of the 0.1 per cent. emulsion, 1.2 for a calyx and three cover sprays of the 0.1 per cent. suspension, and 4.2 for the lead arsenate schedule. There was no significant difference in effectiveness between programmes that included four or five DDT sprays, all of which were significantly superior to lead arsenate. No scorching of fruit or foliage was observed.

No serious mite infestation developed on any experimental block, though both *Bryobia praetiosa*, Koch, and *Tetranychus telarius*, L. (*urticae*, Koch) were present in small numbers.

It is concluded that three applications of a spray containing 0.1 per cent. DDT gives efficient control of *C. pomonella* on Williams' pears and four on Jonathan apples. Observations throughout the fruit-growing areas of Victoria

indicate that better results are obtained by the use of DDT over whole orchards than was apparent from these experiments. Until a satisfactory method of controlling *B. praetiosa* is found, a thorough winter oil spray programme should be carried out; white oil emulsion should not be used in a schedule that includes DDT.

CALDWELL (N. E. H.). **Developments in Codling Moth Control.**—*Qd agric. J.* **65** pt. 1 pp. 53–56. Brisbane, 1947.

An account is given of experiments in Queensland in 1946–47 to compare the effectiveness of lead arsenate, zinc fluoarsenate, DDT and white oil in sprays for the control of the codling moth [*Cydia pomonella*, L.] on apple. All the experimental trees received a calyx spray of 3 lb. lead arsenate and $1\frac{1}{2}$ lb. hydrated lime in 100 gals. water and eight cover sprays of the mixtures under test, timed according to local requirements. The standard lead arsenate spray (3 lb. lead arsenate and $2\frac{1}{2}$ pints white oil per 100 gals. water) gave very poor results and scorched the leaves extensively; more than 40 per cent. of the apples were attacked and almost 10 per cent. of the crop was infested. The addition of $1\frac{1}{2}$ lb. hydrated lime to the formula did not influence control or foliage injury, and though the addition of 1 lb. zinc sulphate improved control, it increased foliage injury and also caused some fruit blemishing and a reduction in the size of the fruit. When 2 lb. hydrated lime and 1 lb. zinc sulphate were both added to the standard formula, control was better, foliage injury was almost eliminated and a general improvement in tree health resulted, but a heavy residue was left on the fruit. A spray of 3 lb. zinc fluoarsenate and $2\frac{1}{2}$ pints white oil in 100 gals. water gave about the same degree of control as the standard lead-arsenate spray and caused equally severe foliage injury.

A spray containing 0·1 per cent. DDT, prepared from a mayonnaise-type emulsion, gave outstanding control; less than 10 per cent. of the fruits were attacked, and less than 1 per cent. of the crop was infested. At 0·05 per cent., the DDT spray was less effective but still gave tolerably good control. The injuries caused by larvae that failed to enter the apples were usually much more superficial following either concentration of DDT than following lead arsenate. DDT caused no foliage injury, and the fruits were well-sized and free from visible residues. Contrary to experience in 1945–46 [cf. *R.A.E.*, A **35** 246], the woolly aphid [*Eriosoma lanigerum*, Hsm.] did not reach injurious numbers on trees sprayed with DDT, though a slight infestation developed on one or two trees, but mites again increased rapidly and caused considerable leaf-mottling. When 1 per cent. white oil was added to 0·05 per cent. DDT, or 1 gal. white oil in 60 gals. water was used alternately with 0·1 per cent. DDT, mite damage was negligible, but when white oil (1 : 60) replaced 0·1 per cent. DDT after the end of December, mite injury was about the same as when DDT alone was used throughout. All these variations in the DDT schedule gave a degree of codling moth control comparable with that obtained with 0·05 per cent. DDT and caused moderate scorching of the leaves. Where the higher concentration of white oil was used, there was also some reduction in fruit size.

The spray schedule of white oil only (1 : 60) gave indifferent control; the percentage of fruit attacked was about the same as with the best lead arsenate spray, but the percentage of apples infested was much higher. Some leaf-scorch occurred, and there was a marked reduction in fruit size.

Dormant sprays should be applied for mite control when DDT is to be used, and, if mites still increase seriously, wettable sulphur should be added to the DDT spray at the rate of 1–2 lb. per 100 gals., or an oil spray (1 : 60) should be substituted for one of the DDT applications. To control a rapid increase of *E. lanigerum*, one or more of the DDT sprays should be replaced by the standard spray of $2\frac{1}{2}$ pints white oil and $1\frac{1}{4}$ pints nicotine sulphate in 100 gals. water,

which will also give some control of mites. This spray can also be substituted for DDT three or four weeks before harvest, in the case of early varieties, to avoid the accumulation of heavy DDT residues on the fruit.

HELY (P. C.). The Citrus Bud Mite (*Aceria sheldoni* Ewing).—*Agric. Gaz. N.S.W.* **58** pt. 9 pp. 471–476, 504, 5 figs., 8 refs. Sydney, 1947.

The literature on the history, distribution, bionomics and economic importance of *Aceria sheldoni*, Ewing, on *Citrus* in the United States and Australia is reviewed [cf. *R.A.E.*, A **30** 429; **34** 126, etc.], and recommendations are made for its control in New South Wales, where it is an important and widespread pest, especially of Navel oranges and lemons [cf. **28** 288]. Observations in January 1939 showed that almost complete mortality of mites and eggs occurred when the temperature rose to 118°F., with a corresponding drop in humidity [cf. **30** 429], and no mites or buds damaged by them could be found a year later on wood that had developed since that time on trees that had been severely infested; *Phyllocoptura oleivorus*, Ashm., which was present on the most exposed parts of the trees, did not appear to be affected by the heat.

Experience has shown that materials containing sulphur give the best control of *A. sheldoni* in New South Wales [cf. **28** 288]; lime-sulphur sprays may be applied at any time, but are most effective in winter, when there is little risk of injury to the trees. Both *A. sheldoni* and *Unaspis (Prontaspis) citri*, Comst., can be controlled with the lime-sulphur spray recommended against the latter [b33 248], applied to the whole tree during June or July. If sprays of Bordeaux mixture have been used earlier in the same season, it may be necessary to confine the strong lime-sulphur spray to the insides of the trees for the control of the Coccid, and to apply a weaker spray, about one-third the concentration, to the foliage against the mite. If Bordeaux mixture is applied in late autumn against snails or fungi, the addition of colloidal sulphur to the spray makes it effective against *Aceria*, but not against *Unaspis*; a tested formula is 1 lb. colloidal sulphur and $\frac{1}{2}$ lb. casein-lime spreader in 40 gals. Bordeaux mixture (2 : 2 : 80). A system of "skeleton pruning" recently developed to rejuvenate unproductive orange and lemon trees is of special value for trees heavily infested by *Aceria*, since it involves the removal of most of the tissue in which the mites develop. Some infestation may appear on the first shoot growth, probably from mites that were in buds on the old wood, but a thorough application of lime-sulphur after pruning should give excellent control of both mites and Coccids.

McCARTHY (T.). Lantana Leaf Bug found on the North Coast.—*Agric. Gaz. N.S.W.* **58** pt. 9 p. 501. Sydney, 1947.

The Tingid, *Teleonemia scrupulosa*, Stål, which was liberated against *Lantana camara* in Queensland and coastal areas in northern New South Wales in 1936–39 [cf. *R.A.E.*, A **28** 317] became well established in northern Queensland, but apparently failed to survive in New South Wales [cf. **35** 220]. Recently, however, it has been found at Cudgen and at Bungabbee State Forest, in the north-east of the latter State, and it is now widely distributed in southern Queensland [cf. **35** 247].

WILSON (F.) & GAY (F. J.). The Fumigation of Wheat in Bag Stacks.—*Bull. Coun. sci. industr. Res. Aust.* no. 207, 24 pp., 4 pls., 1 fig., 14 refs., multi-graph. Melbourne, 1946.

During the war, when the inadequacy of transport caused much bagged wheat in South Australia and Victoria to remain in stacks for long periods at sidings where no adequate arrangements existed for its storage, infestation by insects

and mice often caused serious damage. The insect chiefly concerned was *Calandra oryzae*, L. (small strain); *C. granaria*, L., was frequently present but rarely caused appreciable damage. Outbreaks of *Rhizopertha dominica*, F., occurred in both States, but the losses of bagged wheat were slight. The only serious outbreak of *Endrosis lacella*, Schiff., was at one depot in South Australia in December 1944 in bagged wheat of unusually high moisture content. Other insects that were commonly observed but were not of great importance were *Oryzaephilus surinamensis*, L., *Tribolium castaneum*, Hbst., *Laemophloeus minutus*, Ol., and *Ephestia kuhniella*, Zell. Experiments on control, which have already been noticed from a shorter account [R.A.E., A 33 319], were carried out with carbon bisulphide and a mixture of ethylene dichloride and trichlorethylene (3 : 1), which were later used on a commercial scale [cf. loc. cit.]. Methyl bromide was also tested at a dosage of 2 lb. per 1,000 cu. ft. for an exposure period of 48 hours and gave excellent kill of *C. oryzae* except in the top few tiers in a stack made airtight at the walls only, but it has not been used commercially. However, it has several advantages over carbon bisulphide, since its use involves no risk of explosion and, owing to its remarkable penetrative powers, it could be liberated by means of a tube at a single point at the top of the stack. Consequently, men applying it could remain outside the stack during application and would not risk contact with heavy concentrations of the fumigant, stacks of which the top was not accessible for the manual distribution of the fumigant could be treated and, under certain circumstances, a stack could be made entirely airtight before the methyl bromide was released.

WILSON (F.). Interaction of Insect Infestation, Temperature, and Moisture Content in Bulk-Depot Wheat.—*Bull. Coun. sci. industr. Res. Aust.* no. 209, 31 pp., 9 figs., 10 refs., multigraph. Melbourne, 1946.

In order to obtain further information on the course of insect infestation in bulk-wheat depots in Australia [cf. R.A.E., A 34 121, 230], an experiment was carried out in Victoria in 1944. About 9,000 adults of *Rhizopertha dominica*, F., were liberated on 10th March at a single point where the wheat was 37 ft. deep on the sloping side of a large block of apparently uninfested wheat. *Latheticus oryzae*, Waterh., migrated into the wheat, and became numerous by 25th August. Records of the temperature at depths of up to 9 ft. at this point and at three sampling points 1, 2 and 3 yds. distant along the length of the stack were made every four weeks, and grain taken at depths of up to 5 ft. at the three sampling points on 5th May and every four weeks thereafter until 15th December was examined for insects. Records of moisture content were made from 30th June.

The following is based on the author's summary. The insects penetrated and bred throughout the zone studied during the earlier part of the experiment, but became increasingly restricted to a shallow surface zone with the passage of time. This change in distribution is shown to be caused by the development of lethal physical conditions in the wheat, reproduction near the wheat surface being possible because of the lower temperatures and higher moisture contents. The temperature reached its maximum in October, when the insect density had already begun to decline, and the temperature fell appreciably and the insect density considerably in the succeeding months. The moisture content of the surface zone decreased from the middle of winter and became increasingly inadequate for the reproduction of *Rhizopertha*, and at one time in the height of summer, reproduction was impossible at any level at the sampling point nearest to the point at which the beetles were liberated. Below the surface zone, the wheat moisture content fell slowly throughout the period of the observations.

The rise in vapour pressure as the wheat heated partly accounted for the movement of moisture away from the hottest point, but as the lowest moisture contents did not occur with the highest temperatures, it is necessary to assume also a general upward movement of the air through the heated grain.

It is shown that insect density is largely dependent on the rate at which heat is lost from the mound, and consequently that it is greater in winter than in summer. Data are given showing that serious damage occurs only near the wheat surface. There the loss in weight was as much as 40 per cent., but the percentage rapidly decreased with depth, and the damage was negligible below a level of about two feet.

GREENWOOD (D. E.). The Influence of Cover Crops on Wireworm Injury to Tobacco.—*Bull. Conn. agric. Exp. Sta.* no. 493 pp. 14-16. New Haven, Conn., 1946.

Experience in Connecticut has shown that injury to newly set tobacco plants by wireworms is reduced when rye is used as a winter cover crop [cf. *R.A.E.*, A 34 235]; the wireworms feed on the rye before and for a week or two after it is ploughed in and so remain evenly distributed in the soil and complete their spring feeding without attacking the tobacco plants. In the spring of 1944, serious wireworm injury to tobacco transplants was reported in a field in which a very sparse stand of rye had been ploughed under and the tobacco restocked twice. Field diggings showed a large population of two-year-old wireworms, indicating that infestation was likely to remain for one or possibly two years. A dense stand of rye was grown in this field in the spring of 1945, and although wireworms were still present and active in the early spring, their feeding was completed before the tobacco was planted, and only an occasional plant had to be replaced. For purposes of comparison, an adjoining field, also severely infested with wireworms, was sown with oats in the autumn of 1944; the tobacco that was planted in the spring of 1945 was severely injured, and the field had to be restocked several times. This difference is explained by the fact that the oat cover crop is killed by winter cold and does not provide the wireworms with food in spring.

In a further experiment, potato seed pieces were planted in two neighbouring fields, one of which had a very heavy rye cover crop; when, a week later, 60 pieces were dug at random in both fields, only five wireworms were found in those from the field with the cover crop as compared with 297 in those from the other.

It is emphasised that as the success of this method of preventing wireworm attack on tobacco is in no way related to a reduction in wireworm population, the procedure must be carried out each year and the stand of rye must be adequate.

BRETT (C. H.), WALTON (R. R.) & IVY (E. E.). The Cotton Flea Hopper, *Psallus seriatus* (Reut.) in Oklahoma.—*Tech. Bull. Okla. agric. Exp. Sta.* no. 24, 31 pp., 11 figs., 16 refs. Stillwater, Okla., 1946.

An account is given of work in Oklahoma in 1936-45 on the bionomics, importance and control of *Psallus seriatus*, Reut., on cotton, some of which has already been noticed. This Mirid was found to be most abundant in the south-western part of the State [cf. *R.A.E.*, A 31 170], and there is much local variation in the level of infestation, which is correlated with rainfall, plant succulence [cf. 26 276] and the occurrence of its wild food-plants [30 117] in overgrazed pastures, weedy fields, neglected fence rows and waste areas. Two other Mirids, *Reuteroscopus ornatus*, Reut., and *R. sulphureus*, Reut., were observed on cotton in 1937 and 1938, respectively, and in one area the latter was at times more numerous than *P. seriatus*. For 15 pairs of *P. seriatus*

reared on *Croton* and *Ambrosia*, the preoviposition and oviposition periods (average figures) were 5.3 and 9.5 days, the number of eggs per female was 21.1, the males and females lived for 10.6 and 14.4 days, respectively, and nymphs matured in 17.4 days. For eight pairs of *R. sulphureus*, the pre-oviposition period was 4.6 days, 6.75 eggs were laid per female, males and females lived for 6 and 7 days, respectively, and nymphs matured in 22.2 days. The preoviposition period for one pair of *R. ornatus* was 4 days, and 34 eggs were laid in 18 days. *R. sulphureus* caused less shedding of squares of cotton than *P. seriatus*, and *R. ornatus* a very slight amount. In July and August 1938, *Adelphocoris rapidus*, Say, which is usually considered to be of minor importance, was more abundant on cotton than *P. seriatus* in one locality, and in cage tests it caused considerable shedding.

The appearance of abnormally developed plants or blank stalks in the field was not caused by *P. seriatus*. The loss of squares may not affect yield or may even increase it, since the normal reaction of infested plants was to increase in size and vigour and retain a higher percentage of blooms and set bolls [cf. 33 80]. If fewer bolls were produced, these tended to grow larger and heavier. In dusting experiments in 1936 and 1941-44 [cf. 34 180], sulphur alone gave excellent control of the nymphs, but was comparatively ineffective against the adults except when Paris green or calcium arsenate was mixed with it, and control had little or no effect on yield. In 1945, the percentage reductions in adults and nymphs, respectively, were 55 and 96 for 5 per cent. DDT, 92 and 99 for 10 per cent. DDT, 66 and 92 for sulphur, 51 and 69 for 10 per cent. sabadilla and 30 and 60 for Lethane B-71 [14 per cent. β - β' -dithiocyanodiethylether]. The yield was unchanged by 5 per cent. DDT, increased by 10 per cent. DDT, slightly increased by sulphur, and reduced by the other dusts.

Service and Regulatory Announcements, January-March 1947.—*S.R.A.*,
B.E.P.Q. no. 167, 19 pp. Washington, D.C., U.S. Dep. Agric., 1947.

An Announcement relating to Quarantine No. 72 against white-fringed beetles (species of the genus *Pantomorus*, subgenus *Graphognathus*) (pp. 6-14) includes a revision of the quarantine and its regulations [cf. *R.A.E.*, A 27 274; 32 21], which took effect on 15th March 1947. The main object of the revision is to place the State of Georgia under quarantine and designate as regulated areas parts of 23 counties in that State, where infestations were found in the spring and summer of 1946. Minor additions are made to the regulated areas in Alabama and Mississippi, but there are no changes in the regulated areas of Florida, Louisiana and North Carolina or in the regulated articles. In 1946, a small plot in South Carolina planted with nursery stock from Georgia was found to be infested. The plants were treated under supervision to free them from infestation, and the plot was to be treated with insecticides and kept under surveillance.

Other information in this part includes a revised summary of plant-quarantine import restrictions in Eire (Irish Free State), superseding those already noticed [25 286; 28 90].

ARMITAGE (H. M.) & others. Bureau of Entomology and Plant Quarantine.—
Bull. Dep. Agric. Calif. 34 no. 4 pp. 157-212, 1 map. Sacramento, Calif. [1946.]

Early-season trapping for adults of *Cydia (Grapholitha) molesta*, Busck, in California [cf. *R.A.E.*, A 34 373] in 1945 showed that the moth was present in a continuous area of 3,000 acres under peach in Merced County, where it had not hitherto been recorded, and in further areas in Fresno County involving about 800 acres of preferred food-plants. Since the quantity of fruit involved

was too great to justify compulsory fumigation and a wide range of host fruits suddenly ripened following a cold spell in all the infested areas, the quarantine was extended on 4th July. It soon became apparent, however, that the whole State would have to be included, and so all Californian quarantine regulations were revoked on 19th July. Neighbouring States that maintained quarantines continued to permit the entry of untreated fruits from uninfested counties, provided that they were certified. In subsequent surveys, new infestations were found in three other counties. Extensions in infestation were also found in Colorado, Utah and Idaho and fresh infestations in Oregon and Washington, and, in consequence, the last three of these States and Montana, Nevada and Arizona revoked their quarantines. In California, no fruit infestations and fewer than 50 twig-infesting larvae and 100 adults have been reported north of the Tehachapi. Populations of *C. molesta* were low in 1945 and the effectiveness of the parasites released against it [*Macrocentrus ancylivorus*, Rohw. (cf. loc. cit.)] was difficult to assess, but parasitism exceeded 70 per cent. in the most heavily infested area, and there was some evidence that the moth had been eradicated at three places in each of which less than six adults and larvae had been found in 1943 and over a million parasites had been liberated each year. Over 14 million parasites were released in ten counties during 1945.

The finding of a heavy infestation of *Parlatoria oleae*, Colv., in Los Angeles County in the winter of 1944-45 led to the discovery that the control measures being applied in central California were not preventing natural spread. Its food-plants include all deciduous fruits and many ornamental plants, and, in general, 25 per cent. of the known infestations outside the quarantined area persisted where infested plants were removed and the surrounding susceptible plants sprayed and fumigated, and as many as 78 per cent. where the only treatment was spraying or fumigation or both. In 1942, when *Harrisina brillians*, B. & McD., was first recorded as damaging grape vine severely in California [cf. 32 114; 34 112], it was thought to have spread in a natural manner from Arizona, where it gives rise to irregular outbreaks that are readily controlled and does not spread to any extent. It is now concluded that it must have been introduced into California in some other way, since the intervening desert is an effective barrier. It has spread relatively rapidly in California, and infestations occur regularly and with increasing severity, but since it is restricted to San Diego County, where grapes are not cultivated commercially, an attempt at eradication was considered justifiable. All infested vines and those near them were therefore dusted two or three times with cryolite, which gave satisfactory control in direct proportion to the coverage. The elimination of wild grapes by cutting the vines back, treating the exposed wood with a weed-killer and spraying the top growth that develops in the following spring appears to be practicable. Fumigation with hydrocyanic acid gas has proved far more effective than spraying against *Nilotaspis halli*, Green, on almond, peach and related plants [cf. 34 373-374]. The trees are exposed for 50 minutes under a gas-tight tent, in which liquid hydrogen cyanide is applied at a rate of 40 cc. per 100 cu. ft., and were not damaged by the treatment. Spraying with 2 per cent. emulsible oil in April, when the crawlers are present, and again in October as the trees became dormant, at average rates of 14 and 8 U.S. gals. per tree, respectively, reduces infestation and prevents spread, but has not effected eradication. One small new infestation on almond was found during the year, near an old one.

A further survey of the distribution of *Prunus emarginata* and its associated fruit-flies, *Rhagoletis cingulata*, Lw., and *R. fausta*, O.-S. [cf. 34 108], indicated that the distribution of these Tryptids is limited by some factor other than the occurrence of their food-plant. The lower limits of *P. emarginata* and *Rhagoletis*, respectively, were 3,000 and 4,000 ft. in Placer County, the most northerly in

which surveys were made, 5,000 and 6,200 ft. in Tuolumne County, 7,000 and 7,200 ft. in Tulare County, and 6,600 and over 8,000 ft. in Kern County; the species of *Rhagoletis* was *R. cingulata* in the first two counties and *R. fausta* in the other two. Neither was found farther south, though the food-plant was present at 6,000–8,000 ft. At the higher altitudes in central California, the percentage infestation of *P. emarginata* was 50–60.

Spraying the winter food-plants of *Eutettix tenellus*, Baker, was less effective in 1945 than in the previous year [34 374], owing to shortage of labour and more widespread breeding, which resulted in more leafhoppers developing in inaccessible places. Infestation of sugar-beet near the breeding areas was much heavier than in 1944, but did not extend far to the east or north. South of Fresno County, where until recently sugar-beet was not grown to any extent, no attempt at control had been made, and in the spring of 1945, large-scale breeding took place in Kern County and local crops became infested in April. Infection with curly-top [*Chlorogenus eutetticola* of Holmes] reached almost 100 per cent. in some fields of sugar-beet, despite the use of resistant varieties, and both the yield and purity of the crop were reduced. Losses of early-planted tomatoes were high in the northern part of the county and exceeded 62 per cent. at one place, and the losses of late-planted tomatoes averaged 66 per cent., excluding some over at least 400 acres that were totally destroyed. No such losses of tomatoes occurred in the San Joaquin Valley, and this is attributed to the destruction and spraying of winter food-plants. Autumn populations in 1945 were large owing to the development of unusually large areas of Russian thistle [*Salsola*], favourable weather and the failure of the autumn campaign; early rains caused large-scale germination of annual food-plants in the area in which the Jassids overwinter, as a result of which they did not congregate on perennial food-plants that could be sprayed.

Grasshoppers were not as a rule injurious in 1945. Bait poisoned with sodium fluosilicate was applied wherever heavy infestations developed and, despite the shortage of labour, mostly gave good control. Heavily infested lucerne covering some 6,000 acres on which bait was unsatisfactory was allowed to become dry and was then burnt immediately and irrigated to stimulate new growth. This gave satisfactory control at the cost of only one cutting. Cryolite was successfully used on cultivated crops for which bait was unsatisfactory, but it scorched young sugar-beet plants and caused an estimated reduction in yield of 3 tons per acre. Cold wet weather in spring had retarded the hatching and development of hoppers on range land, and abnormal plant growth on the latter attracted them away from cultivated crops. Many grasshoppers on lucerne in Merced and Kern Counties were killed by a fungus.

Tests in Missouri and California have shown that overwintering larvae of *Cydia molesta* become more resistant to methyl bromide with age, and no reduction could therefore be made in the recommended schedule of exposure for four hours to a dosage of 2 lb. per 1,000 cu. ft. at 70°F. or 3 lb. at 60°F., for the fumigation of winter fruit; larvae in summer fruit were all killed by exposure for two hours to a dosage of 2 lb. at 40°F. [cf. 34 110], however, and fumigation in pre-iced cars may therefore be possible. Only one of three varieties of apple subjected to experimental fumigation was injured by methyl bromide; damage was greater after exposure for four hours than for two, but was less when the fruit was kept in cold storage for three weeks before treatment. Reports were received of damage to fresh plums, but in subsequent tests, plums of the same varieties were not damaged, even when fumigated at a temperature of 90°F. and relative humidities of 30–40 per cent. Complete mortality of pupating larvae of *C. molesta* and the potato tuber moth [*Gnorimoschema operculella*, Zell.] in cocoons in field boxes was obtained by submerging the latter for two minutes in water heated to 180°F. *C. molesta* was the more resistant. *Gardenia* flowers fumigated for two hours with 3 lb. methyl bromide per 1,000 cu. ft. at 60°F.

were still fit for sale two weeks later, whereas untreated blooms became unmarketable in five days. A shipment of 50,000 blooms from Mexico that included propagative parts infested by *Coccus acuminatus*, Sign., was successfully treated with this schedule without injury. With two hours exposure at 80°F., all stages of *Lepidosaphes beckii*, Newm., were killed by $2\frac{1}{2}$ lb. methyl bromide per 1,000 cu. ft., the dosage previously found effective against red scale [*Aonidiella aurantii*, Mask.] on *Citrus*, etc. [34 374], and $1\frac{1}{2}$ lb. killed all stages of *L. machili*, Mask., on *Cymbidium* without injury to the orchids, though 2 and $2\frac{1}{2}$ lb. were injurious. D-D mixture (dichlorpropene and dichlorpropane) gave good control of wireworms when applied to the soil at a rate of 2-2.5 cc. in holes 8 ins. deep and 12-18 ins. apart [cf. also 35 117], and healthy *Camellia* plants growing in soil in cans with a capacity of 5 U.S. gals. were not injured by the application of $\frac{1}{2}$ U.S. pint solution containing 5 cc. D-D mixture in water, which gave complete control of larvae of *Otiorrhynchus (Brachyrhinus) sulcatus*, F., and *Limonius californicus*, Mannh.

In tests with DDT against various pests, the adults and nymphs of the European earwig [*Forficula auricularia*, L.] were killed by concentrations of 2 and 4 per cent. in sulphur dust and 5 and 10 per cent. in an inert carrier. In laboratory tests, 20 per cent. DDT powder mixed with mushroom compost in amounts varying from 0.64 to 1.28 per cent. by weight killed all mites, beetles and *Collembola* present and similar results were obtained when a spray containing 6 lb. 20 per cent. DDT powder per 100 U.S. gals. was applied to the interior of mushroom houses, including the compost, except that a few *Collembola* survived. When only the walls, ceilings, and doors were treated inside and out, flies and beetles were killed, but the crop was severely damaged by mites and *Collembola* in the compost. A dust of 2 or 4 per cent. DDT in sulphur was ineffective against crawlers of *Asterolecanium arabisidis*, Sign., on *Pittosporum tobira*. Good control of storage moths, vinegar flies [*Drosophila*] and other flies in a canning factory was given by treating the walls and ceilings with a spray containing 10 lb. 20 per cent. wettable DDT powder and 1 U.S. gal. light-medium emulsible spray oil in 100 U.S. gals. water.

Insects of economic importance recorded in California for the first time during 1945 were *Hercothrips marginipennis*, Hood, on maize, *Hypera nigrirostris*, F., on the florets, buds and stems of red clover [*Trifolium pratense*], and *Tachardella ferrisi*, Chamb., on *Adenostoma* sp.; *T. ferrisi* had previously been found only in the type locality in Lower California. Insects that increased their range during the year included *Pollinia pollini*, Costa [34 375] which seems, however, to be confined to olive trees planted about 1880 that were imported from Italy, where this Coccid occurs, and *Listroderes obliquus*, Gylh., which was found in desert areas on sweet clover [*Melilotus*], sour clover [*M. indica*] and turnip. *Halticus bracteatus*, Say, which was reported on *Aralia polystachys* in 1944 [34 374] and *Dichomeris marginella*, F., which attacks juniper and was also reported for the first time in California in 1944, are both stated to have been eradicated. Including records in 1945, *Aceria camelliae*, Keifer [35 325] has been recorded in six counties; it infests the buds and flowers of *Camellia*, which appears to be its only food-plant, causing the scales of the flower buds to turn brown and possibly some of the buds and flowers to drop prematurely. Similar damage is caused by *Acaphylla steinwedeli*, Keifer, which was taken on *Camellia* in Los Angeles County in 1942 and in two other counties in 1945, generally associated with *Calacarus udornatus*, Keifer [34 109]. Insects observed in the course of nursery inspections included *Dynaspidiotus britannicus*, Newst., on boxwood [*Buxus*] in two counties, *Otiorrhynchus (Brachyrhinus) meridionalis*, Gylh., *Parlatoria pittospori*, Mask., on *Leptospermum*, and larvae of *Emboletocia sauzalitae*, Grote, boring in Easter lilies [*Lilium longiflorum*]. *Phyllocoptruta oleivorus*, Ashm., damaged lemon at two places outside the San Diego area, which is usually the only one in which it injures *Citrus*, and is therefore thought to

exist in small numbers along the southern Californian coast north of San Diego to Santa Barbara. Other pests recorded include *Cylindrocopturus crassus*, Van D., which burrows in the stems of chrysanthemum, to which it probably spreads from native composites, a larva of *Hepialus behrensi*, Stretch, which normally mines the stems and roots of ferns and lupins, from the trunk of an apple tree, *Aceria sheldoni*, Ewing, which was observed on lemon in the San Bernardino area in October and had not previously been of importance so far inland, *Eucosma* sp., larvae of which were found in a nursery in October tunnelling the stems of chrysanthemum at and below soil level, and *Fiorinia theae*, Green, on *Camellia*, of which it is a considerable pest in Alabama and other southern States.

The report also includes sections dealing with the incidence of pests on various crops in different parts of the State and with pests intercepted at maritime ports, airfields and border inspection stations, and notes on the revisions of State quarantine regulations.

BALL (W. S.) & others. Bureau of Rodent and Weed Control and Seed Inspection.—*Bull. Dep. Agric. Calif.* **34** no. 4 pp. 228-246. Sacramento, Calif. [1946].

It is stated in the course of this report that, following the release of limited numbers of *Chrysomela (Chrysolina) hyperici*, Forst., and *Chrysomela quadrigemina*, Suffr. (*Chrysolina gemellata*, Rossi) in several areas in California for the control of Klamath weed (*Hypericum perforatum*) [cf. *R.A.E.*, A **35** 161], indications were obtained in 1945 that the insects were becoming established and feeding on the plants.

McKENZIE (H. L.). General Distribution of Red Scale, *Aonidiella aurantii* (Maskell) in California.—*Bull. Dep. Agric. Calif.* **35** no. 2 pp. 95-99, 1 fig. Sacramento, Calif., 1946.

The author gives a list of localities in 28 counties in California in which *Aonidiella aurantii*, Mask., has been taken, showing the plants on which it was found. A map illustrating its distribution shows that it is widespread in the San Joaquin Valley and in the southern coastal areas and occurs in isolated regions along the coast further north. It is not of much importance in commercial *Citrus* orchards in the San Joaquin Valley, where control measures tending to eradication are practised, but occurs on isolated trees and on ornamental plants. Other food-plants include avocado, olive, walnut, willow, bamboo and some weeds. Collections indicate that it is spreading gradually and persistently throughout the interior valley counties and occurs in the open as far north as Butte and Glenn Counties and in desert districts in Riverside County, and that further spread to the east and west as well as to the north may be anticipated.

LINDGREN (D. L.), LADUE (J. P.) & HARRIS (L. S.). Preliminary Field Experiments on the Control of Purple Scale with DDT incorporated in Petroleum Oil.—*Bull. Dep. Agric. Calif.* **35** no. 2 pp. 100-102. Sacramento, Calif., 1946.

Lepidosaphes beckii, Newm., which is one of the most important Coccids attacking *Citrus* in California, occurs in San Diego, Orange, Los Angeles, Ventura and Santa Barbara Counties, but not in Riverside and San Bernardino Counties or in the *Citrus*-growing areas of the San Joaquin and Sacramento valleys, with the exception of one small infestation in the city of Sacramento. It has three generations and sometimes a partial fourth in the year, and the young hatch in large numbers in May and June and again in September and

October. Fumigation with hydrocyanic acid gas in late summer or autumn, when the young are present, with applications of about 2 per cent. light mineral oil before or after fumigation in heavily infested groves, is the best control measure now in use [cf. R.A.E., A 31 57]. Laboratory experiments have shown, however, that DDT deposits on the fruit prevent any young from developing for as long as 45 days after spraying. Since at certain times of the year most of the scales are in the adult stage and eggs are deposited over a relatively short period (3-4 weeks) and hatch in 2-3 weeks, sprays were applied to heavily infested trees to determine whether suitably timed applications of emulsified solutions of DDT in oil would prevent the young from settling and developing. All spray quantities are given per 100 U.S. gals., and 4 oz. powdered blood albumin was the emulsifier for each spray. The percentage kills on trees sprayed in May 1944 and (in brackets) the percentages of fruits infested about a year later were 6 (65) for 3 U.S. gals. kerosene, 16 (7) for 1 lb. DDT in 3 U.S. gals. kerosene, 26 (5) for this spray with 12 oz. ground cubé root, 64 (25) for 1½ U.S. gals. mineral seal oil, 90 (4.5) for 8 oz. DDT in 1½ U.S. gals. mineral seal oil, 85 (11) for the last spray with the addition of 6 oz. ground cubé root and 0 (66) for no treatment. DDT gave some increase in initial kill, whereas cubé root had little or no effect, and there was no correlation between initial kill and the number of infested fruits per tree a year later, since the main effect of the DDT was prevention of development of the crawlers. Many of the fruits infested a year after they had been sprayed with DDT bore only a few scales, whereas fruits on untreated trees and those treated with kerosene alone usually had many. In May and June 1945, various sprays were applied to these and other plots. All treatments that did not include DDT had to be repeated in September, owing to the great increase in infestation, but sprays of 1½ U.S. gals. mineral seal oil with 8 oz. DDT and 3 U.S. gals. kerosene with 2 lb. DDT and an auxiliary solvent kept the population extremely low until the time of writing (March 1946), though a few small infestations were then appearing on trees treated with 3 per cent. kerosene and 1 lb. DDT at a time when all stages of *L. beckii* were present.

Before it is known whether DDT can be recommended against *L. beckii* in California, it will be necessary to determine its effect on parasites, predators, mites and other Coccids and the best time to spray.

RYAN (H. J.). Some Los Angeles County Experiences with new Insect Pests and Insect Eradication Projects.—*Bull. Dep. Agric. Calif.* 35 no. 3 pp. 124-125. Sacramento, Calif., 1946.

A list is given of 25 insects, including 19 Coccids, that have been eradicated from Los Angeles County, California, since 1924, showing the year in which they were found, the probable length of time they had been established and the number of infestations. The discovery of 17 of them resulted from systematic nursery surveys and inspections made in 1938-46, and all these were eradicated at a cost that was probably less than that of eliminating *Melanaspis (Chrysomphalus) obscura*, Comst., or *Dialeurodes (Aleurodes) citri*, Ril. & How., which were well established when they were found. Among the eradicated insects were many of unknown economic importance, though all are known to attack crops or ornamental plants and might have become serious pests of major crops, and seven are recorded in the literature as attacking plants that are of major economic importance in California; these are *Aspidiotus destructor*, Sign., and *Ferrisia (Pseudococcus) virgata*, Ckll., on avocado, *Fiorinia theae*, Green, and *Howardia biclavis*, Comst., on *Citrus*, *Pulvinaria psidii*, Mask., on avocado, *Citrus* and persimmon, *Toumeyella liriodendri*, Gmel., on walnut, and *Asterolecanium pustulans*, Ckll., on peach and fig.

MORRISON (A. E.). **Insects infesting Camellias.**—*Bull. Dep. Agric. Calif.* **35** no. 3 pp. 131-140, 31 refs. Sacramento, Calif., 1946.

This is a summary, based on the literature, of information on the insects, mites and other invertebrates that attack *Camellia*, chiefly in the United States, with very brief descriptions of the Coccids, which comprise the majority, and notes on the feeding habits of the Coleoptera and Lepidoptera.

PALMER (D. F.) & THORNE (F. T.). **The Western Grape Leaf Skeletonizer.**—*Bull. Dep. Agric. Calif.* **35** no. 3 pp. 143-144. Sacramento, Calif., 1946.

Harrisina brillians, B. & McD., has continued to spread in California [*cf. R.A.E.*, A **36** 185], and by 1946 it occurred on patches of wild or cultivated grapes scattered over an area of more than 2,000 square miles. The eggs are laid in masses of about a hundred, usually on the undersides of the leaves, and the larvae feed on these, the earlier instars leaving only a transparent tissue and the later ones only the veins. The cocoons are spun under loose bark or in rubbish round the vines, often in masses, and there appear to be three generations a year. Preference is shown for cultivated grape vines of all varieties, including the Concord types, though wild grapes and allied plants are also attacked [*cf. 32* 114], and the fruit is sometimes eaten, but usually only when the foliage has been completely consumed. The progeny of the adults that emerge in May and June can defoliate vineyards completely by early July. The vines produce second growth, which, if not devoured, remains long after normal vines are dormant. Repetition of this injury seriously weakens the vines, and if the fruit is not consumed it is destroyed by sunburn owing to the loss of foliage. It has been the authors' experience that a 20-acre vineyard infested by a single gravid female one year will be about one-third defoliated by the end of the second year and completely so by July of the third season unless control measures are used.

In San Diego County, infestation shows no tendency to abate from natural causes. The Zygaenid thrives both within a few miles of the coast and in the desert and occurs at elevations ranging from 500 to over 3,000 feet. Attempts are being made to eradicate it, but this has become increasingly difficult with the finding of new infestations in remote areas. The adults were not considered to be vigorous flyers, but the fact that new colonies have been found ten miles from the nearest food-plant indicates the possibility of rapid natural spread.

KLARENBERG (K. A.). **Aantasting van stoppelknollen door *Helophorus* spec.** [Infestation of Turnips by *Helophorus*.]—*Tijdschr. PlZiekt.* **52** pt. 4 pp. 121-122, 1 pl., 2 refs. Wageningen, 1946. (With a Summary in English.)

In October 1943, turnips in many parts of Holland were attacked by larvae of the genus *Helophorus*, which were particularly abundant in the "bulbs" just below the surface of the soil. In early November, infestation was very severe in one locality near Wageningen, where the plants were stunted, with bright red leaves that lay shrivelled or rotting on the ground, and were found to be severely attacked by numerous large larvae. Hydrophilids of this genus, which are known to be widely distributed in the Mediterranean region as well as in England [*cf. R.A.E.*, A **17** 121], were also recorded in Holland in 1935 [*cf. 24* 404], when kohl-rabi was attacked by the adults in July and the larvae infested cauliflowers in the autumn. In 1945, small larvae were observed on young turnip plants early in September, and infestation was severe in some fields.

GOIDANICH (A.). **Su alcuni Calcidoidei Afelinini parassiti dell'Aonidiella perniciosa Comst. in Italia.** [On some Aphelinid Parasites of *Quadraspisdiotus perniciosus* in Italy.]—*Boll. Ist. Ent. Bologna* **15** pp. 20–24, 16 refs. Bologna, 1945.

In view of a recent study by A. Melis of *Quadraspisdiotus (Aonidiella) perniciosus*, Comst., and its natural enemies in Italy [R.A.E., A **36** 64–65], the author states that three parasites reared by him from examples of that Coccid on apple from Tuscany supplied by Melis in 1933 proved to be *Aphytis bovelli*, Malen., *Prospaltella fasciata*, Malen., and *Aspidiotiphagus citrinus*, Craw. Notes are given on the alternative hosts and the distribution of these Aphelinids, all of which had previously been recorded in Italy but had not been found in the field in central Italy. They all parasitised both the immature Coccids and the adult females; the first was ectophagous and the other two endophagous.

GOLFARI (L.). **Etiologia ed ecologia dell'afide farinoso del pesco, *Hyalopterus arundinis* Fabr.** [The Behaviour and Ecology of *H. arundinis*.]—*Boll. Ist. Ent. Bologna* **15** pp. 129–170, 14 figs., 34 refs. Bologna, 1946.

The peach orchards in the neighbourhood of Cesena, in Emilia, deteriorated in the course of the war, largely owing to the impossibility of controlling insect pests. The bionomics and control of one of these, *Hyalopterus arundinis*, F. [cf. R.A.E., A **25** 316, 657] are discussed from observations made in the field in 1945–46, and notes are given on its distribution and food-plants, and on the climate of the district. A comparison of data on weather and the prevalence of the Aphid during 1939–46 indicates that rainfall in May and June and its absence in early autumn favour the development of heavy infestations.

The winter eggs were laid in October and November, close behind the buds on year-old twigs of peach. The maximum number observed per tree was 175, distributed over 54 twigs, but many are usually destroyed by predators, chiefly spiders and mites, or cut away when the trees are pruned, so that few survive the winter, although they can withstand severe frost. The fundatrices hatched when the mean daily temperature reached 10°C. [50°F.], following a few warmish days, usually in middle or late March. They fed first on the sepals of the flower buds and moved to the leaves as these developed. They became adult in 17–24 days and gave rise to about 60 offspring each. The apterous fundatrigeniae matured in 12–17 days, and gave rise to about 100 offspring. As the colonies increased in size, they spread to all parts of the tree. Some Aphids that fell to the ground ascended other peach trees and thus spread the infestation. The Aphids reached their maximum numbers by mid-June; on trees well provided with moisture they continued until autumn, producing 6–14 generations, but in dry years they are not usually present between the end of July and autumn.

Alatae appeared during May, among the third generation, and formed an increasingly high proportion of the three subsequent generations; migration of alates began when the peach trees started to show signs of lacking moisture. The summer food-plant was *Phragmites communis*, which is common along watercourses in the region. Only relatively small numbers appeared to reach these reeds; they settled on the underside of the youngest leaves and gave rise to a succession of apterous generations. The winged gynoparae were produced after the early autumn rains, and the winged males a little later; both returned to peach from mid-October until the leaves fell. The winged gynoparae that returned to peach, and also those produced by any apterous colonies that had persisted on the trees, each gave rise to 9–10 sexual females. These were fertilised by the males and laid 3–4 overwintering eggs each.

The presence of *H. arundinis* on peach does not become noticeable until mid-May. Healthy trees in well-watered situations are mainly attacked, but trees less than five years old are not usually affected. The infestation causes the leaves to curl inwards and downwards; the fruit is small and tasteless and usually covered with honey-dew and sooty mould. Repeated heavy infestations cause defoliation and the eventual death of the branches chiefly affected, and a general diminution of flower and leaf production. In Emilia, the main damage is to peach, with some varietal differences in susceptibility, while plum and other cultivated species of *Prunus* are less attacked. Colonies were rarely found on graminaceous plants other than *Phragmites communis*; the Aphids were unable to complete their development on *Arundo donax*. Peach trees of varieties preferred by them frequently showed symptoms attributed to a virus disease, and trees that were weakened from a combined attack by *H. arundinis* and *Coryneum* also became infested by *Scolytus rugulosus*, Ratz.

Numerous parasites and predators were observed attacking *H. arundinis*. Of these, Coccinellids and Arachnids were most active in spring and autumn, Syrphids in late spring, and unidentified Braconids and Chalcidoids in summer. Lists of the insect predators are given. In tests on control, two types of tar distillate and a petroleum oil spray were applied to some trees in late December and to others in early February, to destroy the overwintering eggs [cf. 26 62]. Very good results were obtained on each date with one of the tar distillates, which killed 92 and 96 per cent., respectively, of the eggs present, compared with a mortality of 14 and 11 per cent. on untreated controls. The oil spray was less effective, and the other tar-distillate much less so. A spray of nicotine sulphate and a spreader gave the best control of the fundatrices; a quassia spray was fairly effective, but two rotenone sprays were useless. At least two applications should be given, one before the flower buds unfold and one at petal fall. In a supplementary note, the author reports that a suspension of 0.1 per cent. DDT was about as effective as nicotine sulphate and gave more lasting results.

MARTELLI (M.). L'*Athalia colibri* Christ (Hymenoptera Tenthredinidae) e i suoi danni a Crucifere oleaginose in Emilia. [A. rosae injurious to cruciferous Oil-seed Plants in Emilia.]—Boll. Ist. Ent. Bologna 15 pp. 184-202, 3 pls., 67 refs. Bologna, 1946.

In the spring of 1944, severe infestation by *Athalia rosae*, L., (*colibri*, Christ) was observed near Bologna on white mustard (*Sinapis alba*) in an experimental field of oil-seed plants; rape was only slightly affected and the other plants, comprising *Camelina sativa*, castor (*Ricinus communis*), soy bean and sunflower, not at all. The geographical distribution and food-plants of this sawfly and measures for its control are discussed from the literature [cf. R.A.E., A 28 166; 30 545] and all stages are briefly described.

The adults were first observed in the field at the end of April, and were very numerous by 5th May, when mustard was in flower. Pairing and oviposition took place soon after emergence. The eggs were laid in incisions in the lower surface of the leaves; up to four eggs per leaf were found, but one or two were more frequent. Females under observation laid 10-23 eggs in a day, but their total egg-production was not ascertained. They survived for about 14 days. The larvae hatched after about a week and fed on the leaves. The upper epidermis was not touched at first, but the leaves were later completely perforated and sometimes skeletonised; flowers and seeds were also attacked, and each plant harboured 10-30 larvae. Cabbages in the vicinity of the mustard were not infested. The larvae became full-grown in 20-25 days and pupated in the soil in cocoons made of earth and silk. The adults emerged 15-20 days later, from 20th June onwards. A second generation was reared

in the laboratory from eggs laid about the end of June. The larvae hatched in 4-8 days, became full-fed in 40-50 days, entered the soil about the end of August, overwintered in their cocoons, and pupated in the following April.

Brief notes are given on six parasites of *A. rosae* reared by the author; the most important was *Perilampus italicus*, F., and the others were *Blondelia* (*Lydella*) *nigripes*, Fall., *B. (L.) virilis*, Rond., and three unidentified Ichneumonids, two probably of the genera *Mesoleius* and *Anilastus*, but none was very numerous.

ROBERTI (D.). *La Phenobremia aphidimyza (Rond.) (Diptera-Cecidomyidae) predatrice di Aphis (Doralis) frangulae Koch.* [*P. aphidimyza* predacious on *A. gossypii*.]—*Boll. Ist. Ent. Bologna* **15** pp. 233-256, 15 figs., 6 refs. Bologna, 1946.

Detailed descriptions are given of all stages of the Cecidomyiid, *Phenobremia aphidimyza*, Rond., which the author found to be a common predator in Campania on *Aphis gossypii*, Glov. (*frangulae*, auct.) on cucurbits. Its bionomics are discussed from observations and from the literature. The eggs were laid in spring, singly or in groups of 3-4, on the underside of the leaves of pumpkins or other cucurbits on which colonies of the Aphid were present. Under favourable conditions, a single female laid over 100 eggs. The larvae, which fed on the liquid contents of the Aphids, became full-grown in about a week in July, at a mean temperature of 26°C. [78.8°F.]; they then dropped to the ground and pupated in cocoons in the surface soil. The adults emerged after 8-9 days. No natural enemies of the Cecidomyiid were observed, but in very dry ground, many larvae died before completing their cocoons. Several generations developed in the course of the summer, and as there were often several dozen larvae to one pumpkin leaf and it was estimated that each larva destroyed 60-80 Aphids, the author considers that they must have effected considerable control.

MELIS (A.). *Nuovo contributo alla conoscenza della biologia della tignola dell'olivo (Prays oleellus F.) ed al modo di combatterla.* [A further Contribution to Knowledge of the Biology of the Olive Moth, *P. oleellus*, and its Control.]—*Boll. Ist. Ent. Bologna* **15** pp. 257-286, 5 pls., 2 figs., 4 refs. Bologna, 1946.

In view of previous work [*R.A.E.*, A **36** 141], investigations on the bionomics and control of *Prays oleellus*, F., on olive in the neighbourhood of Florence were carried out in 1946. Pupation of the first-generation larvae in the laboratory began on 31st May, and though first-generation pupae were not seen in the field until 3rd June, the adults began to emerge on 7th June and were numerous from 10th June. The females laid their eggs on the leaves, the upper surface and veins being preferred, or on the young fruits, most often on the calyx. Oviposition was at its height at the beginning of July, and the moths had disappeared by the end of that month. The incubation period lasted about a week; the first eggs hatched in the middle of June. The larvae mined straight into the leaf or fruit, beneath the egg-shell; in the fruits, they travelled towards the kernel, often interfering with the passage of sap, so that the olives withered on the tree or fell to the ground. Infestation was known to cause the fruits to fall in September, but it appeared that far more serious losses occurred earlier, in June-August. These were apparently due to the larvae, since the percentage infestation was about 95 in fallen fruits examined in July, as compared with only about 29 in those that remained on the tree, and was

constantly above 90 in fallen fruits from two trees that were examined at frequent intervals from 30th June to 25th August. The fall of fruits was accentuated by rain or wind, and appeared to have some relation to fluctuations in oviposition. The percentages of all fruits that fell from these two trees during this period were 26 and 43, as compared with 3 and 4, respectively, in September.

It was not clear where the larvae pupated. By the beginning of September, few living larvae were found in leaves, and many of the galleries had exit holes. Of fallen fruits examined in early September, 70 per cent. had been abandoned by the larvae. When the remainder were kept in the laboratory, larvae emerged from some of them and gave rise to adults on 22nd September, and most of the others were found to contain dead larvae. Fallen olives collected after 10th September did not contain living larvae, although a few of them had exit holes and some contained parasitised larvae. No adults were observed between early September and mid-October in or near olive groves, and no cocoons on leaves, branches or trunks and only a few among the weeds under the trees. Samples of soil taken from under the trees in the first half of September and kept in the laboratory until the end of November, failed to give rise to adults. It is not known whether emergence took place before these samples were taken, or if the prolonged drought caused a particularly high mortality of larvae. A few eggs were observed by the end of November, mostly on the upper surface of the leaves, and examination of leaves from three trees at the end of November showed mines in 13 per cent. of them. Most of these had been constructed by second-generation larvae, a few of which were still present, but some were of recent construction; living larvae were present in nearly all the latter.

Sprays of 0.5 per cent. lead arsenate and of an unspecified improved arsenical product were applied twice against larvae of the first generation, on 21st and 24th May. Each application was followed by heavy rains, but both insecticides gave high mortality, and the improved material was so persistent that it also killed many second-generation larvae on the calyces of the young fruits. It increased the crop by about 25 per cent., but neither treatment appreciably reduced the percentage of fruits infested. Contact insecticides, including DDT, applied against the second-generation eggs gave poor results.

FAGGIOLI (D.). *Appunti entomologici. VII. Osservazioni biologiche sulla Cydia pomonella L. (Lepidottero Tortricide) sviluppantesi sulle noci.* [Entomological Notes. VII. Observations on the Bionomics of *C. pomonella* on Walnut.]—*Boll. Ist. Ent. Bologna* **15** pp. 287-291, 6 figs. Bologna, 1946.

Walnuts (*Juglans regia*) in the neighbourhood of Bologna are heavily infested by *Cydia pomonella*, L. In field observations in 1946, the first eggs were seen on 2nd May and the first larvae on 14th May. The larvae mined in the pericarp of the fruits for about three weeks and then penetrated the endocarp and entered the kernel. The surface of the infested fruits turned black and most of them fell to the ground; of 200 fallen fruits collected on 16th June, 119 had mines in the kernel, while the remainder had galleries that had not penetrated the endocarp. Pupae were observed on 18th June, mostly in the soil or in fruits, and adults on 28th. Second-generation eggs were present on 9th July and hatched on 19th; the larvae generally mined directly into the kernel through the division between the two halves of the shell, since they were unable to penetrate directly through it. These larvae were less numerous than those of the previous generation, since most of the first-generation females oviposited on apple or pear. The larvae began to construct their cocoons in the first half of September and overwintered.

RUSSO (G.). **Scolitidi del pino del litorale toscano. Note di biologia.** [Scolytids in Pines on the Coast of Tuscany. Notes on Biology.]—*Boll. Ist. Ent. Bologna* **15** pp. 297–314, 6 figs., 7 refs. Bologna, 1946.

The observations here recorded were begun in 1941 and carried out chiefly in stands of *Pinus pinea* near Pisa and Leghorn, where the felling of large numbers of trees by German troops led to a serious outbreak of Scolytids. Those reared in the laboratory from infested material comprised *Myelophilus (Blastophagus) piniperda*, L., var. *rubripennis*, Rtr., *Hylurgus ligniperda*, F., *Crypturgus pusillus*, Gylh., and *Ips erosus*, Woll., but only the first of these is regarded as an important forest pest, since it was the only one to attack living trees. Characters are given distinguishing it from the typical variety and the males from the females, the egg is described, and a detailed account is given of its bionomics. The other three species are dealt with very briefly.

M. p. rubripennis overwintered not only as a larva but also as an adult in its feeding gallery on the tree or in fallen twigs. Of galleries examined during December–January, 35–50 per cent. contained beetles. They left the galleries on mild days at the end of February and constructed egg galleries on trees that had fallen or been felled or weakened through any cause, but not in dry wood. The males fertilised the females at the entrance to these, and some of them assisted in the work of mining. The galleries ran down the tree, between the bark and the sapwood. Each female laid about 100 eggs, and the mining of the gallery took 40–50 days. In 1946, females that began galleries during early February in pine trunks felled in mid-January completed them in late March. On completion of their galleries, the females either died in them or flew to healthy trees and fed in them. Males also left the breeding galleries. Some of the eggs were destroyed by the flow of resin, and those that were not destroyed hatched in 7–10 days, according to temperature, and the larvae mined irregular galleries, in an upward direction in the inner bark, injuring the phloem. These attacks sometimes killed weakened trees and those transplanted in summer, especially under dry conditions. The larvae became full-fed in about two months and pupated in chambers near the surface. In 1946, eggs deposited on 15th February hatched on 25th February, the first pupae were observed on 13th April, the first adults emerged at the end of the month, and most of them left the trees on 15th–25th May. On emergence, adults flew to healthy trees and mined the twigs, and when sexually mature, constructed egg-galleries as before. Development of the second generation lasted from June to August–September, and under favourable conditions there was a partial third generation. Some larvae of the second generation and all those of the third overwintered and gave rise to adults from mid-February to May of the following year, while some adults of the second generation that had already reproduced also overwintered. The galleries of all types are described. The natural enemies observed included the Braconid, *Dendrosoter protuberans*, Nees, and the predacious Clerid, *Thanasimus formicarius*, L.

BROADBENT (L.). **Alate Aphides trapped in north-west Derbyshire, 1945.**—*Proc. R. ent. Soc. Lond. (A)* **21** pt. 7–9 pp. 41–46, 6 refs. London, 1946.

In connection with a survey of Aphids infesting potatoes, traps were operated from early May to mid-November in six fields containing main-crop potatoes at altitudes of 340–1,280 ft. in north-west Derbyshire in 1945. Each trap consisted of a piece of iron stove-piping, 3 ft. long and 16 ins. in circumference, painted white; it was coated with an adhesive material and mounted on a post so that the top was 6 ft. from the ground. The number of alates of each of some 115 species taken on each trap, with the total number of each species taken

at all the six traps and their periods of flight and maximum flight, are shown in a table. Species of which more than 1,000 alates were taken are *Drepanosiphon platanoides*, Schr. (1,041), *Rhopalosiphum crataegellum*, Theo. (3,418), *R. prunifoliae*, Fitch (*padi*, auct.) (2,664), Aphids of the group of *Aphis (Doralis) fabae*, Scop. (1,009), *Cavariella aegopodii*, Scop. (4,005), *Macrosiphum (Acyrthosiphon) onobrychis*, Boy. (2,309) and *M. (Metopolophium) dirhodum*, Wlk. (2,615). Considerably fewer Aphids were taken on the three traps situated above 1,000 ft. than on those at lower levels, probably because conditions there were less sheltered and there was a smaller variety of food-plants. Certain species, including *Drepanosiphon platanoides*, *R. prunifoliae*, the *fabae* group and *C. aegopodii*, were more abundant at the lower altitudes, and some of economic importance, including *M. dirhodum*, *M. onobrychis*, *M. solanifolii*, Ashm., *M. avenae*, F., *M. fragariae*, Wlk., and *Myzus persicae*, Sulz., occurred in similar numbers at all altitudes. Many species were less numerous on two of the traps at lower altitudes that were situated in deep, narrow valleys sheltered by trees than on the third, which was in a wide valley, and it is suggested that air currents may have carried the Aphids above them.

ALFARO (A.). **El escarabajo de la patata en el año 1945.** [The Potato Beetle in the Year 1945.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 1-8, 1 map. Madrid, 1946.

The season of 1945 was unusually hot and dry in Spain, and potato crops were poorly developed. The potato beetle [*Leptinotarsa decemlineata*, Say] appeared in most places about a fortnight earlier than in previous years, but a considerable drop in the temperature at the beginning of May interrupted oviposition and killed eggs and young larvae, so that populations were not large, except in a few places. There were two generations in most districts, and a third in some, and adults of the last generation were present well into the autumn. Because of the growing use of chemical control methods, only slight damage was caused; sprays of lead or calcium arsenate were used against the larvae and, in some cases, against the adults, but DDT and benzene hexachloride proved more effective against the latter. Various stages of the beetle are destroyed by predators in some localities. Those identified were *Coccinella septempunctata*, L., which destroyed the eggs, *Polistes gallicus*, L., *Zicrona coerulea*, L., and *Rhynocoris (Harpactor) iracundus*, Poda, which attacked the larvae, and *Decticus albifrons*, F., which attacked the larvae and adults. The distribution of the beetle at the end of the season is discussed at some length and shown on a map, from which it appears that only the Provinces of Huelva and Cadiz, in the south-west, and Corunna, in the extreme north-west, were free from infestation [cf. *R.A.E.*, A **35** 148], though several of the southern Provinces had only isolated foci. It is thought that the beetle may now have reached its climatic limits.

GÓMEZ CLEMENTE (F.). **Las "serpetas" que atacan a los agrios: *Mytilococcus beckii* (Newmann) y *Mytilococcus gloverii* (Packard).** [Coccid Pests of Citrus: *Lepidosaphes beckii* and *L. gloveri*.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 9-54, 22 figs., 26 refs. Madrid, 1946.

The author reviews the systematic position, the geographical distribution and the history of the spread in Spain of *Lepidosaphes (Mytilococcus) beckii*, Newm., and *L. (M.) gloveri*, Pack., which are injurious to *Citrus* on the Mediterranean coast [cf. *R.A.E.*, A **34** 269]. The former is present in the Provinces of Alicante, Almería, Barcelona, Castellón, Málaga, Tarragona and Valencia,

and the latter in Alicante, Murcia and Valencia. Descriptions are given of the crawlers and the adults of both sexes, together with information on bionomics and control, based partly on the literature. Observations in 1944, chiefly on orange, at Burjasot, Valencia, where *L. beckii* is the more abundant, showed that females of this species laid an average of 30–40 eggs, those of the last generation being the more prolific. One female observed in November laid 107 eggs. The oviposition period lasted for up to 43 days, and the eggs hatched in 12–15 days at 21–27°C. [69·8–80·6°F.] and in 18–19 days at 18–26°C. [64·4–78·8°F.], both at 80–100 per cent. relative humidity. No eggs hatched at 13–16°C. [55·4–60·8°F.]. The crawlers survived for up to three days without food. The formation of the scale is described. Males took 42–47 days to complete their development, and the period between the attachment of the crawlers of one generation and the appearance of crawlers of the next was 58–65 days. The proportion of the sexes varied, but females slightly predominated on the average. All stages were present throughout the year, but the later forms were most numerous in winter. The bionomics of *L. gloveri* were very similar, but the females produced fewer eggs (14–20, with a maximum of 32). Both species attacked fruit, leaves, twigs and branches and preferred the lower and more shaded parts of the trees; on the coast, the eastern side was attacked first. Heavy infestation led to defoliation and death of the branches involved. *Aspidiotiphagus citrinus*, Craw, parasitised 6–8 per cent. of *L. gloveri* at one place, and *Chilocorus bipustulatus*, L., was predaceous on both species, but not very effective. Various treatments that have been used in Spain against these Coccids are reviewed. The most effective are spraying in summer and early autumn with 1·5–2 per cent. light medium or medium oil and fumigation with hydrocyanic acid gas under tents, preferably in August for orange and December–April for lemon. The technique of fumigating is described.

PLANES (S.) Datos sobre la biología de la oruga de las cápsulas del algodonero (*Earias insulana* (Boisduval)) en el Levante de España. [Biological Data on the Cotton Bollworm (*E. insulana*) in eastern Spain.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 69–78, 8 figs., 3 refs. Madrid, 1946.

The increase in the cultivation of cotton in eastern Spain has made necessary a study of the bionomics of *Earias insulana*, Boisd., which has been present since the crop was first introduced, in 1944. All stages are briefly described. Females of the earlier generations laid their eggs on the flower-buds or terminal shoots, but as soon as bolls were formed, the eggs were laid on these, usually on the upper part and along the junction of the carpels. The average number of eggs per female was 100–150; the oviposition period lasted 30–40 days, so that there was considerable overlapping of stages. The larvae entered the bolls and fed on the seeds; they pupated in cocoons attached to the outside of the bolls or to the stalks. No cocoons were observed in the ground, as recorded in other countries. The early generations are not numerous enough to cause much damage, but late cotton was often severely injured in late September and early October. Infested bolls opened prematurely, and often rotted or withered, and the cotton obtained from them was of poor quality. Early sowing diminished the injury, as the larvae attacked green bolls rather than ripening ones. A table is given showing times taken to complete the egg, larval and pupal stages at temperatures of about 20°C. [68°F.], corresponding to the months of September and October. There was less information available for higher temperatures, but it was estimated that the egg, larval and pupal stages averaged 3, 15–20 and 7–8 days, respectively, in midsummer as compared with 6, 25 and 15–25 days in late September and October. There are thought to be 4–5 generations in the course of the cotton season.

RUIZ CASTRO (A.). *El "cigarrero" de la vid (Byctiscus betulae L.).* [The Leaf-rolling Vine Weevil, *B. betulae*.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 95-130, 1 col. pl., 11 figs., 13 refs. Madrid, 1946.

The weevils that injure grape vines in Spain are *Byctiscus betulae*, L., *Geonemus flabellipes*, Ol., *Cneorrhinus* spp. and *Otiorrhynchus* spp. A key is given to these four genera, together with others distinguishing *Byctiscus* from *Rhynchites* and *B. betulae* from *B. populi*, L. All stages of *B. betulae* are described, its nomenclature and distribution are discussed, and an account, based largely on the literature, is given of its bionomics and control.

The adults appear at about the end of April, and feed to some extent on the shoots and young leaves and the females roll the leaves tightly together to form a receptacle for their eggs. The adults become sexually mature and pair 8-10 days after emergence, after which the males die off while the females survive for about a month. The eggs are inserted into the rolled leaves, and each female lays about 5-6; several may oviposit in the same roll. The eggs hatch in June in about ten days, and the larvae feed on the rolled leaves. They become full-fed in 3-5 weeks, leave the roll and enter the ground. The prepupal and pupal stages each last 10-12 days, but the adults usually remain in the soil until the following spring. In very warm years, some adults emerge in autumn and overwinter in shelters on the surface of the soil, but a second generation has never been recorded.

Lists are given of the alternative food-plants and natural enemies of the weevil; none of the latter is known in Spain. *B. betulae* occurs in La Rioja and parts of Vascongadas and Navarre; infestation is usually not heavy enough to be of much importance, but outbreaks take place from time to time. The control methods discussed include hand-collection of the adults and the rolled leaves and spraying with lead arsenate. Sprays of DDT or benzene hexachloride are recommended on the basis of their effectiveness against other weevils.

DEL CAÑIZO (J.). *Ensayos de aplicación del D.D.T. en la lucha contra el gorgojo de las flores del manzano, Anthonomus pomorum (L.).* [Experiments with DDT for the Control of the Apple Blossom Weevil.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 169-180, 6 figs., 10 refs. Madrid, 1946.

Serious losses of apples have been caused in recent years in Spain by *Anthonomus pomorum*, L., which in some cases has destroyed nearly all the flowers. It occurs in the Provinces of Corunna, Santander, Biscay, Guipúzcoa and Almería, but is more injurious in Saragossa, Teruel (with the adjoining territory of Rincón de Ademuz), Barcelona and Tarragona, and in parts of Ávila. The control measures in general use are not very effective, and Spanish products containing 5 per cent. DDT with adjuvants in an inert carrier were tested at 1 per cent., one in Biscay in 1944 and two in Barcelona in 1945. In 1944, when the adults appeared in the first week of March, the percentages of blossoms attacked on sprayed and (in brackets) untreated trees in various localities were 10-20 (25), 1-10 (28) and 1-10 (21) for treatment on 4th April, 8th March or 6th February, respectively, and, at another place, less than 1 (34) for treatment on 5th February, 6th March and 10th April, the first of these dates only or the first two only. It was concluded that 1-2 applications gave good control provided that the first was made early enough to kill the adults before the eggs were laid. Spraying should be begun when the buds begin to swell and be completed before the tips of the petals show.

The two products tested in 1945 were both applied to trees of two varieties that had received a winter spray of mineral oil against Coccids and an arsenical spray in late January, which was too early to affect the results. The trees were sprayed on 15th March, when a few adults had appeared and the flower

buds were beginning to open, and the percentage of blossoms attacked was reduced from 32.8 to 0.24 and 1 on one variety and from 17 to 0.03 and 0.4 on the other. The difference between the varieties is attributed to difference in date of flowering, and that between the two products to differences in manufacture.

DEL CAÑIZO (J.) & URQUIJO (P.). **Experiencias sobre la eficacia insecticida del gamma-hexano (γ -666) contra los pulgones (Aphidos).** [Experiments on the insecticidal Efficiency of the γ Isomer of Benzene Hexachloride against Aphids.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 181–188, 4 refs. Madrid, 1946.

An account is given of experiments carried out in Corunna in 1946, to assess the value of the γ isomer of benzene hexachloride as a substitute for nicotine in the control of Aphids. The product used contained 75–80 per cent. kaolin, 15 per cent. soap and glue and enough benzene hexachloride (35–50 per cent. γ isomer) to give 2 or 3 per cent. γ isomer. The results were based on counts of living and dead Aphids remaining on the leaves after 24 hours; in some cases, a considerable number of Aphids abandoned the sprayed plants.

In tests on 28th July in clear windy weather against *Hyalopterus arundinis*, F., and *Rhopalosiphum nymphaeae*, L., on plum and *Aphis laburni*, Kalt., on beans, in which sprays containing 0.2–1 per mille γ isomer were used, 1 per mille without an additional wetter gave 99.3 and 80 per cent. mortality on the two food-plants, respectively, as compared with 99.5 and 99 per cent. for 0.5 per mille with a wetter (Ipem) consisting of a resinous product with the addition of terpenes, and similar results were obtained in tests with other Aphids. A subsidiary test, made three days later, on the effect of wetters on the mortality given by a spray containing 0.5 per mille γ isomer showed that soft soap at 1, 2.5 or 5 per mille was very effective and more so than Ipem or another resinous product, its effectiveness increasing with concentration. In the final test, carried out on 5th August in windy and somewhat overcast weather, against *R. nymphaeae* on plum, the mortality percentages were 21, about 94 and 99 for 0.2, 0.4–0.6, and 1 per mille γ isomer without a wetter, 99–100 for 0.2–0.6 per mille with the addition of 0.25 per cent. soft soap, and 98 for 0.5 per mille nicotine with 0.25 per cent. soap.

The maximum and minimum temperatures for the 12 days covering the experiments are shown in a table; the highest temperature was 30.6°C. [87.08°F.] on 3rd August and the lowest 9°C. [48.2°F.] on 28th July. The relative humidity ranged from 70 to 75 per cent.

BENLOCH (M.). **Ensayos de laboratorio sobre la acción por contacto de los insecticidas orgánicos clorados (D.D.T. y 666).** [Laboratory Tests of the Contact Action of the organic chlorinated Insecticides DDT and 666.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 189–198. Madrid, 1946.

Tables are given showing the results of laboratory experiments in 1945–46 on the value of various preparations of DDT and benzene hexachloride as contact insecticides. The products were mixed with water at the required concentrations, and as soon as the mixtures were made, filter papers were dipped in them, shaken slightly, and placed at the bottom of jars in which adults of *Leptinotarsa decemlineata*, Say, were confined; the jars were covered with gauze and were examined daily for six days. Four preparations containing 5 per cent. DDT were tested at dilutions of 1 per cent., and gave average mortalities that ranged from 58.2 to 94 per cent., but mortality in the control jars was sometimes

very high. A 1 per cent. concentration of a product containing 15 per cent. benzene hexachloride (a mixture of isomers) gave complete mortality and another preparation of the same composition killed all the beetles exposed to it at concentrations of 1.5 and 2 per cent., and 29 out of 30 at 1 per cent. A preparation of the technically pure γ isomer of benzene hexachloride gave a complete kill when used at the rate of 0.03 per cent. of this isomer, but killed only 21 and 24 out of 25 insects in two tests at 0.15 per cent. In this test, 8 of the 25 control insects died. A derivative of a mixture of isomers of benzene hexachloride, thought possibly to represent a new isomer, gave complete kill in two tests at 0.07 per cent., and killed 21 out of 25 at 0.1 per cent.; 8 out of 25 in the control jar died. The uneven results obtained in some cases with the same product were attributed to differences in temperature and season.

URQUIJO (P.). **Selección de estirpes de *Trichogramma minutum* Riley de máxima efectividad parasitaria.** [The Selection of Strains of *T. minutum* of maximum Efficiency as Parasites.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 199–216, 7 figs., 4 refs. Madrid, 1946.

The author describes further experiments in Spain on the separation of more effective strains of *Trichogramma minutum*, Ril. [cf. *R.A.E.*, A **35** 152]. Selection was based on fecundity, or the number of eggs per female, and ovotropism, or the faculty of seeking out suitable host eggs in which to oviposit. Laboratory experiments have shown that *Trichogramma* is apt to be deficient in this faculty, often attempting to utilise "false hosts" [23 390], and field experiments in 1943 [33 125] showed that it does not find hosts at small distances from the place at which it emerges.

The strains were originated from single pairs of *Trichogramma* by methods that are described, and the host eggs were those of *Sitotroga cerealella*, Ol. Each generation of each strain was subjected to tests as to the number of eggs parasitised and the number of viable parasites produced, and by 1946, 3,984 generations had been bred; inferior strains were abandoned. The number of viable parasites was found to be affected by the state of the host eggs, variations in temperature, and the number of eggs deposited in one host (since, when several were laid in the same host, they usually failed to develop), rather than by the strain involved. The proportion of males to females did not generally vary significantly, although several strains died out owing to the appearance of an all-male generation following one in which the females reproduced parthenogenetically. The number of eggs laid per female was found by placing single parasitised host eggs in separate tubes and introducing a card bearing at least 150 eggs of *Sitotroga* into each tube in which a female emerged. After six days, counts were made of the eggs showing signs of parasitism, and the average for each strain was calculated from ten or more counts. In most cases, the average was below 40, which is considered low.

In order to observe the ovotropism of the strains, a card of parasitised eggs was placed at one end of a glass container about ten inches long, and when the adults emerged, a box containing *Sitotroga* eggs under wire gauze was placed at the opposite end, away from the light, so that the females had to overcome their positive phototropism in order to find the eggs and oviposit in them. In later tests, the wire gauze boxes were replaced by solid ones with a small entrance hole on the darkest side. A light was kept constantly burning at the opposite end of the glass containers, which were kept at 22–25°C. [71.6–77°F.]. Extracts from the records are given. So far, no increase in fecundity had been observed as a result of selection, but some strains showed improved ovotropism. A total of 237 strains was being studied.

GÓMEZ CLEMENTE (F.) & BELLOD Y BELLOD (M.). **Duración del poder atrayente que sobre el *Dacus oleae* (Rossi) ejercen las soluciones de fosfato amónico. Segundo año de experiencias.** [The Duration of the Attraction for *D. oleae* of Solutions of Ammonium Phosphate. Second Year of Experiments.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 217-224, 4 graphs, 1 ref. Madrid, 1946.

Experiments on the duration of attraction to *Dacus oleae*, Gmel., of baits of 4 per cent. ammonium phosphate in glass traps [R.A.E., A **35** 150-151] were continued in Valencia in 1935. Two series of tests were made, from 19th July to 13th September, and from that date to 24th November, on a group of 20 olive trees, each of the same size and variety and bearing an average crop; all the traps were filled and hung up at the same time, one in each tree. In each row of five trees, two traps in which the solution was renewed fortnightly were placed alternately with two in which it was merely strained and replaced; the fifth trap contained plain water renewed fortnightly, in order to assess how far the attraction was due to thirst. The traps were moved every week, so that each one hung in turn on all the trees in the row. Fortnightly counts were made of the numbers of *D. oleae* caught, and the results are shown in tables and graphs. Only small numbers of flies were caught in the traps containing plain water. The amount of liquid left after 45 days in the traps in which it was not renewed varied from 20 to 260 cc.; it was then divided equally among them. The numbers of flies caught in these traps were 100.93, 96.09, 58.52 and 70.61 per cent. of those in the traps in which the liquid was renewed fortnightly at the four counts made during the first experiment, and 97.58, 93.50, 73.86 and 74.95 per cent. in the second. These results confirmed the conclusions reached in the previous year [cf. loc. cit.].

GÓMEZ-CLEMENTE (F.) & BELLOD [Y] BELLOD (M.). **Influencia de la concentración en el poder atrayente que sobre la mosca del olivo (*Dacus oleae*) ejercen las soluciones de fosfato amónico.** [The Effect of the Concentration of Solutions of Ammonium Phosphate on their Attraction for *D. oleae*.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 225-236, 1 fig., 10 refs. Madrid, 1946.

An account is given of tests carried out during the years 1943-45 with a view to reducing the concentration of ammonium phosphate used in bait-traps for *Dacus oleae*, Gmel., on olive in Spain [cf. preceding abstract]. The arrangement of the experimental plots is described. The solutions in the traps were renewed fortnightly, and counts were made of fruit-flies taken in them. These figures, together with the results of statistical analysis of them, are shown in tables and briefly discussed. In 1943, when solutions of 2, 3, 4 and 5 per cent. ammonium phosphate were compared, the differences between them were not statistically significant, though the lower concentrations were slightly the more effective [cf. R.A.E., A **30** 480]. In the following year, the total numbers of flies taken in traps containing water changed fortnightly or 2, 4 or 6 per cent. ammonium phosphate were 1,735, 10,486, 11,099 and 6,614, respectively. There was no significant difference between the last three, but all were significantly superior to water only. In 1945, the numbers caught in traps containing 2, 4 or 6 per cent. ammonium phosphate or water changed fortnightly or left so as to permit the growth of algae totalled 9,664, 6,460, 4,151, 2,075 and 1,646, respectively. The differences between ammonium phosphate and water and between the 2 and 4 or 6 per cent. solutions were highly significant, that between the 4 and 6 per cent. solutions was barely significant, and that between water with and without algae was not significant. It was concluded that the 2 per cent. solution could be recommended for use, provided that its attraction was found to persist as long as that of a 4 per cent. solution.

MORENO MÁRQUEZ (V.). **Orientaciones para la localización de focos gregarígenos del *Dociostaurus maroccanus*.** [Suggestions for discovering the Foci in which Outbreaks of *D. maroccanus* originate.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 237-252, 8 figs., 14 refs. Madrid, 1946.

This is a discussion of the factors that lead to locust outbreaks, with special reference to *Dociostaurus maroccanus*, Thnb., in Spain [cf. *R.A.E.*, A **35** 153]. Transformation from the solitary to the gregarious phase cannot be due to mutation, since it occurs in numerous individuals at a time, and must therefore be the result of some variation in the environment of the solitary locusts, that is, a change in vegetation, soil or air conditions. As, however, the soil does not alter within the space of a few years, and the vegetation depends on soil and atmospheric conditions, the change must be in the latter, and most probably in the microclimate. Changes in microclimate lead to concentrations of locusts in patches of territory favourable to them and consequently to transformation to the gregarious phase.

To establish the nature of these microclimatic requirements by direct methods would be difficult, but some idea can be formed of the type of country most likely to contain outbreak centres, within the areas where locusts are known to breed. Level or only slightly sloping ground or ground covered by luxuriant vegetation is unsuitable, since the microclimatic conditions in them tend to remain the same; the most favourable conditions are provided by arid, undulating country with sparse vegetation, which, by its broken nature, offers varying and uneven conditions [cf. **28** 29]. Examples of the type of territory described are given from among the known breeding places of *D. maroccanus* in Spain [26 698].

GÓMEZ-MENOR ORTEGA (J.). **Afidos que viven sobre plantas de huerta.** [Aphids that feed on Garden Crops.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 253-308, 121 figs., 33 refs. (annotated). Madrid, 1946.

The author gives a key to the three families that he recognises in the Aphidoidea (the APHIDAE comprising the ERIOSOMATINAE and the APHIDINAE), a brief account of the annual cycle of the APHIDAE and the various ways in which they damage plants, keys to the genera and species of this family that feed on vegetables and other garden crops, or are likely to do so, in Spain, and a list of the species, with their synonyms, descriptions of the alate and apterous viviparous females, and notes on food-plants and local distribution.

ALFARO (A.). **El ácaro *Pediculopsis graminum* Reut. y el hongo *Nigrospora oryzae* (Berk. et Br.) Petch, en asociación parasitaria sobre trigos aragoneses.** [The Mite, *Pediculoides graminum*, and the Fungus, *N. oryzae*, in parasitic Association on Wheat in Aragon.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 321-334, 12 figs., 14 refs. Madrid, 1946.

Up to 20 per cent. of the wheat crop in fields in the Province of Huesca failed to form ears in 1945, as a result of attack by the mite, *Pediculoides (Pediculopsis) graminum*, Reut., in association with the fungus, *Nigrospora oryzae*. Fungus and mites were observed within the leaves just above the basal node. The fungus is distributed by the non-ovigerous females, and the mites feed on it and on the plant tissues destroyed by it, although they can also feed on healthy tissues. All stages of the mite are described, and notes are given on its distribution and alternative food-plants. Males constituted only 10-15 per cent. of the total population at the end of the summer, when they were most numerous. There appeared to be 2-3 generations a year.

The fungus is also discussed and described. In laboratory tests, wheat plants were infected by spraying them with a suspension of spores, without the intervention of *P. graminum*. The association, believed to be here recorded for the first time in Spain, is thought to aggravate the injuries caused by each agent separately. It is not known whether either is likely to cause economic damage in other years; the wheat crop was poor in 1945 because of unfavourable weather.

ALFARO (A.). *Ensayos de lucha contra algunas plagas de la alfalfa con insecticidas de síntesis orgánica.* [Experiments in the Control of some Pests of Lucerne with organic Insecticides.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 335-342, 3 figs., 1 ref. Madrid, 1946.

Lucerne in Spain suffers considerable damage from the Chrysomelid, *Colaspidema atrum*, Ol. [cf. *R.A.E.*, A **23** 667] and the weevils, *Hypera (Phytonomus) variabilis*, Hbst., and *Apion elegantulum*, Germ., the first two being the most injurious. The use of arsenicals against them is unpopular, owing to the risk of poisoning cattle fed on the hay, and experiments were therefore carried out with six proprietary Spanish products containing 5 per cent. DDT and one containing 15 per cent. mixed isomers of benzene hexachloride. All these preparations were used as sprays at a concentration of 1 per cent. In the first test, on 22nd March, two plots of lucerne were sprayed with two DDT preparations and treated plants were then given as food, renewed daily, to 30 adults of *C. atrum*, 15 of *H. variabilis* and 17 of *A. elegantulum* while 15 of each species were kept as controls. The percentages of dead in five days were 80, 73 and 65, respectively, for one preparation, and 90, 93 and 65 for the other. One example of *A. elegantulum* in the controls died on the fourth day. On 3rd April a second test was made in the same manner, and using the same sprays, against 25 adults of *C. atrum* and 25 larvae of *Hypera*. Both sprays killed 64 per cent. of the latter in five days, and a complete kill of *C. atrum* was obtained in four days with the first spray and in five with the other. Some larvae pupated in the course of the experiment, and the percentage of these that gave rise to adults was as high as in the controls. On 17th April, three other DDT products and benzene hexachloride were similarly tested against 25 half-grown larvae of *Hypera*, which were allowed to feed on plants from plots ready for the first mowing that had been sprayed at the rate of 90 gals. per acre. The mortality percentages were 84, 84 and 72 in four days for the three DDT sprays, 88 and 96 in two and three days for the benzene hexachloride, and 16 in four days for the controls. In all these experiments, good results were also observed in the sprayed plots as compared with untreated areas.

In a fourth test, on 5th May, two of the DDT sprays and the benzene hexachloride spray were applied at 198 gals. per acre, together with the benzene hexachloride product as a dust at 58.5 lb. per acre, to second-crop lucerne heavily infested by larvae of *Colaspidema*. After 44 hours, all the treated plots were free from living larvae, except for a very few in that sprayed with benzene hexachloride. In a few days the treated plots could be recognised by their more luxuriant vegetation. The last test took place on 22nd May, when lucerne heavily attacked by larvae of *Colaspidema* was sprayed with the sixth DDT product and two of the others at a rate of about 112 gals. per acre. After 44 hours one of the products had given good mortality, while the others were less effective; the resulting difference in the condition of the plants became obvious at the end of a week and the relative efficiency of the sprays was confirmed by laboratory tests.

It is concluded that all the materials tested gave good control of *Colaspidema*, though they were less satisfactory against *Hypera*, and that there is considerable variation in the insecticidal qualities of commercial products stated to contain the same proportion of DDT.

BENLLOCH (M.). **Observaciones sobre la eficacia insecticida de los preparados comerciales a base de DDT y gamma-hexano.** [Observations on the insecticidal Efficiency of commercial Preparations of DDT and Benzene Hexachloride.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 343-352, 1 graph. Madrid, 1946.

This is a discussion of the causes of the discrepancies observed in Spain in the effectiveness of spray powders of DDT and benzene hexachloride stated to contain the same amount of active ingredient, based on analyses of various Spanish products. It was found that the main factors responsible were the proportion of active to inactive isomers, the presence of impurities, the particle size and distribution of the active component in the carriers and the stability of the product in suspension. The method of preparing the suspension was also important.

DOMÍNGUEZ GARCÍA-TEJERO (F.). **Las pulguillas de las crucíferas cultivadas.** [The Flea-beetles of cruciferous Crops.]—*Bol. Pat. veg. Ent. agric.* **14** pp. 353-368, 9 figs., 1 ref. Madrid, 1946.

The flea-beetles that injure cruciferous crops in Spain are *Phyllotreta nemorum*, L., *P. undulata*, Kutsch., *P. vitulata*, Redt., *P. variipennis*, Boield., *P. atra*, F., *P. cruciferae*, Goeze, *P. nigripes*, F., and *Psylliodes chrysocephala*, L. *Phyllotreta nemorum* is the commonest of these in the Basque provinces and Castille and *P. cruciferae* in Galicia; both are particularly injurious in seed-beds. *P. variipennis* occurs in Toledo, in association with *P. cruciferae*. Since the species are often wrongly identified, short descriptions are given of the adults and in some cases also of the larvae and eggs, together with a key distinguishing the adults from each other and from Halticids that are seldom or never harmful to cultivated crucifers.

All the eight species have one generation a year and overwinter as adults. Those of the genus *Phyllotreta* become active at the end of May and feed on the leaves of crucifers. The eggs are laid singly, usually on the earth near the stems of the plants, but those of *P. nemorum* are laid on the leaves. The larvae feed on the roots or leaves, respectively, but cause no economic damage. They pupate in the soil and the adults emerge during the summer. The adults of *Psylliodes* emerge in summer and begin to oviposit in September, laying their eggs near the base of the plants. Oviposition is interrupted by the onset of winter and resumed in the following spring. The eggs hatch in a few days and the larvae bore in the roots and stems, often inflicting considerable injury. They pupate in the soil.

Cultural control methods comprise keeping the plots free from weeds, especially wild crucifers, sowing early and thickly, and treating the seed beds with nitrogenous fertilizers to promote growth, so that the seedlings are sufficiently far advanced to resist attack. Heaps of hay or straw are attractive to the adults in search of winter quarters and can be burnt after hibernation has begun. Dusting with calcium arsenate or nicotine is recommended. Experiments on the effectiveness of DDT against flea-beetles in other countries are reviewed [*R.A.E.*, A **32** 381, 383; cf. also **35** 303]; in Spain, Benlloch obtained good control in 1944 with 1 per cent. of a dust containing 15 per cent. benzene hexachloride applied against flea-beetles on cabbage, and Alfaro in 1945 with 1 per cent. of dusts containing 5 per cent. DDT, applied against the beet flea-beetle, *Chaetocnema tibialis*, Ill.

MORALES AGACINO (E.). **Presencia accidental de la langosta del desierto, *Schistocerca gregaria* (Forsk.), en el noroeste de la Península Ibérica.** [A chance Invasion of *S. gregaria* in the North-west of the Iberian Peninsula.] —*Bol. Pat. veg. Ent. agric.* **14** pp. 385–392, 1 map, 1 graph, 3 refs. Madrid, 1946.

Swarms of *Schistocerca gregaria*, Forsk., were observed in numerous places in western Portugal and in 17 in and near the north-western coast of Spain between 12th and 25th October 1945; their distribution is shown on a map. They probably originated from Morocco, and the weather conditions that induced the migration are discussed, largely from a paper by Z. Waloff [see next abstract]. The adult locusts observed in Corunna were mostly immature, although some appeared to be approaching sexual maturity. The general colouring ranged from greyish brown to red. The body measurements of a male and a female are given, and from them it is considered that the locusts were entering phase *transiens dissocians*. They were not very numerous, the swarms being small and dispersed; no economic damage was caused.

WALOFF (Z.). **A long-range Migration of the Desert Locust from southern Morocco to Portugal, with an Analysis of concurrent Weather Conditions.** —*Proc. R. ent. Soc. Lond. (A)* **21** pt. 10–12 pp. 81–84, 1 fig., 9 refs. London, 1946.

Swarms of *Schistocerca gregaria*, Forsk., were reported at 22 places along or near the coast of Portugal between Lisbon and the northern frontier on 12th October 1945 and some locusts were also seen at Vigo, Spain, at about the same date. Most of the locusts were sexually immature, but some mature individuals were observed at two places. Swarms produced in French West Africa generally migrate in autumn across Mauretania and Rio de Oro to Morocco [see next abstract], and a large immature swarm including some mature individuals was reported in south-western Morocco in the Sous Valley, ten miles from the Atlantic coast, on 9th October 1945; no other swarms were present in Morocco or Algeria at that date. The swarm was still present on the next day, and it was slightly nearer the coast on the day after. The swarms observed in Portugal were all flying south, and from a consideration of their distribution on the day of their appearance and the fact that none had been reported flying over Morocco, it is concluded that they travelled over the sea, covering a distance of over 800 miles. Since swarms of this species usually settle at night, and since D. L. Gunn states that they travel about 20–30 miles during a day, the weather conditions at the time of the migration were investigated. Swarms begin to fly at temperatures of 19–23°C. [66·2–73·4°F.]. On 10th October, the temperature favoured flight for only a short period, but on 11th, it rose sharply from 68°F. at 6 a.m. to 95°F. at noon, while an easterly wind was blowing with a force of 20–30 miles per hour. This wind persisted for a few miles over the sea and then gave place to a southerly current, which probably extended to a height of over 5,000 ft., blew over the eastern Atlantic during the day and night and was sufficiently strong at an altitude of 1,500–2,000 ft. to carry the locusts to Portugal by 6 a.m. on 12th October. Migration therefore probably started early in the morning of 11th October, when the sharp rise in temperature indicates the setting up of convection currents that could carry the locusts to the level at which the southerly current was strong before they were blown out to sea. Some evidence was obtained that the temperatures at that altitude remained sufficiently high for flight, at least by day, over the whole course. The locusts were probably enabled to settle in Portugal by a decrease in the strength of the wind at high altitudes and at surface level that occurred during the night of

11th-12th October and on the following day. Earlier records, mostly relating to the 19th century, of swarms carried out to sea are discussed, and it is concluded that the migration of 1945 was not exceptional.

DONNELLY (U.). **Seasonal Breeding and Migrations of the Desert Locust** (*Schistocerca gregaria* Forskål) in western and north-western Africa.—*Anti-Locust Mem.* no. 3, 42 pp., 1 fig., 19 maps, 37 refs. London, 1947.

The seasonal distribution of breeding and the major trends in the migration of *Schistocerca gregaria*, Forsk., in western and north-western Africa were investigated from data obtained during 1927-37 and from 1941 to July 1944, when outbreaks were in progress. The topography and climate of the area and the methods adopted, which were similar to those employed in the work on the activity of the locust in eastern Africa [R.A.E., A 36 123], are described. A study of reports received at the Anti-Locust Centre and the published data indicates that breeding takes place over two large areas, both characterised by a single well-defined rainy season. The more northerly of these, designated the main spring breeding belt, comprises Morocco, Algeria, including the north part of the *Territoires du Sud*, Tunisia, and northern Tripolitania, as well as smaller areas in central and southern Rio de Oro, adjoining areas in Mauretania, the centre and south of the *Territoires du Sud*, and Tripolitania. It receives rain chiefly in autumn, winter and spring, and hatching takes place during March-July. The more southerly, designated the monsoon breeding belt, includes southern Mauretania, Senegal, the French Sudan, the Niger Colony, north-eastern Nigeria and the Chad Territory, as well as areas farther north in Mauretania, the centre of the *Territoires du Sud*, and south-eastern Libya. It receives rain during the monsoon, in summer, and hatching takes place in July-October. In addition, hatching was reported in January-February over a discontinuous belt in western Mauretania, Rio de Oro and south-western Morocco, and in November-December in a fairly large area along the River Senegal and in another extending from Central Rio de Oro northwards to southern Morocco and westwards to north-eastern Mauretania; it occurred in May-June in an area in the Niger Colony north of the Nigerian boundary in 1944 and in one in the north-eastern Chad Territory in 1945. In general, breeding takes place only once a year in the two main breeding belts; it may occur twice in districts in the Atlantic coastal region that receive rain in winter as well as in the monsoon season, and in the centre of the *Territoires du Sud*, where rain falls in winter and spring, and three times within and near the Ahaggar highlands (central Sahara), where rainfall is irregular, but may be provided by the Mediterranean rains in winter and spring and the monsoon rains in summer.

Adults appear in the monsoon breeding belt from the end of August until early December, and the swarms migrate from September until January, greatly increasing in number in October-November. The majority fly in a northerly, north-easterly, or, less frequently, a north-westerly, direction across the Atlantic coast zone in southern Mauretania, the Saharan plain in central Mauretania, and the northern Chad lowlands to the Atlas region and Tripolitania. Those that reach the areas where breeding is possible in November-December during those months mature and breed, and the resultant swarms follow the trend of the general migration. There is some movement in easterly, south-easterly and south-westerly directions within the Mediterranean area from October onwards. During December-January the number of swarms leaving the monsoon breeding area decreases and during February-March movement from this region ceases. The monsoon and winter swarms may be supplemented by early spring swarms from February onwards, and from this month the main trend of migration in the Mediterranean area is in a north-easterly direction,

though there is a southerly movement from south-west Morocco. By April-May, the central desert region is free from swarms; some may reach the Mediterranean coast in Algeria, Tunisia and Spanish Morocco at this time. The old swarms in Tunisia and Tripolitania generally die out in May, but the northerly movement is still distinct in June in Algeria, though it becomes indistinct in Morocco; in both, the swarms occasionally persist until the middle of July. A smaller, westerly migration from the monsoon breeding area also begins in September. It increases in October and November, when it extends from the Chad Valley lowlands to the River Senegal, and ultimately results in an accumulation of swarms between the Niger inundation region and Senegal, Gambia and French Guinea in December-January. At the same time, there is some southerly migration, and in 1930 swarms from the Chad lowlands entered the Belgian Congo and Uganda. In February-March, the swarms migrate from the Atlantic coast over French Guinea, Sierra Leone, the Ivory Coast, the Gold Coast, Dahomey and central and southern Nigeria, and by April-May the coast is free. At that season, most swarms move northwards and occur mainly in the Niger inundation area in the French Sudan, the Niger Colony and northern Nigeria, but the easterly trend continues until June, when the swarms enter the Chad Territory and the Anglo-Egyptian Sudan.

The spring-generation swarms are not present in the main Mediterranean breeding zone until May, but they sometimes appear on the Atlantic coast in April. Migration begins in April or May, mostly to the south, south-east or south-west, and the locusts have left the breeding area by the end of August. Swarms on the Atlantic coastal plains begin to fly eastwards in May and June, and in July-August there is a continuous movement extending from the coast across the French Sudan, the Niger Colony, northern Nigeria and the Chad Territory and into the Anglo-Egyptian Sudan. The old swarms begin to die off in September-October.

In a discussion of the evidence relating to the annual breeding cycle of this locust, it is concluded that there are two main generations each year, and sometimes an intermediate one in winter or early spring. The monsoon breeding period lasts for 4-5 months in some years, and the development of a supplementary generation is then possible. It is unlikely that there are four successive generations in such years, however, since the supplementary swarms do not necessarily migrate northwards, but may become involved in the southward migration, during which breeding does not take place.

BALCH (R. E.) & REEKS (W. A.). **Report on Forest Insects in New Brunswick, 1945.**—109th Rep. Dep. Lds Min. New Brunsw. 1944-45 pp. 123-125. Fredericton, N.B., 1946.

Increased sampling in 1945 indicated that the spruce budworm, *Harmologa (Archips) fumiferana*, Clem., was no more abundant in New Brunswick than it had been in the previous year [R.A.E., A 35 8]; an examination of the crowns, within 5 ft. of the top, of 434 recently felled trees from a mature stand of balsam fir [*Abies balsamea*] showed that the population averaged only one larva per three trees. A fairly high proportion of the larvae were parasitised by *Angitia (Horogenes) cacoeciae*, Vier., and some by *Zenillia (Epimasicera) caesar*, Aldr., and *Phaeogenes hariolus*, Cress. The susceptibility of a stand to attack increases with its age and content of balsam fir, and there is need to concentrate felling in areas with the largest stands of mature and overmature balsam fir in order to reduce the risk of serious losses from another outbreak; there is some evidence that a type of balsam fir that produces many staminate flowers is favourable to *H. fumiferana* [cf. also 35 79]. Populations of the spruce sawfly, *Gilpinia hercyniae*, Htg., were in general relatively low [cf. 35 9], though moderately large numbers were reported in a few limited areas. The

virus disease of the larvae occurred in most samples collected at the end of the year and appeared to be the major controlling factor, though the introduced larval parasites, *Exenterus claripennis*, Thoms., *E. vellicatus*, Cushm. [cf. 29 294] and *Sturmia* sp. exerted considerable control and were as important as the disease in one area.

Dieback of birch continued and *Agrilus anxius*, Gory, which is one of the factors involved [cf. 34 130], was still numerous; surveys in two counties showed that the percentage of dead or dying trees was 85 among yellow birch [*Betula lutea*] and 45 among younger stands of white birch [*B. papyrifera*]. The outbreak of *Malacosoma disstria*, Hb., in Madawaska and Victoria Counties [35 9] continued, but was less severe near Perth, where it originated in 1943 [33 155], and the peak is believed to have passed. Mortality occurred chiefly among trees of small diameter, and trees at Perth were beginning to recover. A moderate infestation of beech by *Cryptococcus fagi*, Baer., was reported in the St. John Valley, 15 miles north of the limit of infestation in the previous year. Infestation was in general more severe than in 1944, and mortality among the larger trees continued throughout the southern half of the Province; the felling of these trees as soon as possible after the appearance of white threads in any quantity on the bark is recommended, since the stem generally begins to decay before the branches and the timber may begin to deteriorate before the tree dies. *Chermes (Adelges) piceae*, Ratz., increased somewhat in numbers on *Abies balsamea* [cf. 35 9], and new, scattered, heavy attacks occurred, chiefly in the centre of the Province. *Coleophora laricella*, Hb., was less numerous on larch, though still quite abundant, especially in the north-west. *C. salmani*, Heinr., caused browning of the foliage on birch in two counties, and *Alsophila pometaria*, Harr., defoliated elms in the Fredericton district. Parasites liberated during the year comprised 1,908 of *Chrysocharis laricinellae*, Ratz., and 4,301 of *Agathis (Bassus) pumila*, Ratz., against *Coleophora laricella*, and 12,400 of *Sturmia* sp. against *G. hercyniae* and other insects.

MCKAY (R.) & LOUGHNANE (J. B.). **A Survey of Flax Diseases in Éire in 1945.**
—*J. Dep. Agric. Éire* **43** pp. 24-30, 5 refs. Dublin, 1946.

It is stated in the course of this report that attack by *Longitarsus parvulus*, Payk., threatened to become serious on flax in Éire in 1945, but was checked by the onset of showery weather. Injury by *Calocoris norvegicus*, Gmel. (*bipunctatus*, F.) was slight and occurred only on plants next to fences. Tipulid larvae were responsible for an almost complete failure of the crop in one field in Donegal.

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SONAN (J.). **Notes on the parasitic Hymenoptera of *Naranga aenescens* Moore (Lep. Noctuidae)** [including a description in English of *Meteorus narangae*, sp. n., from Formosa]. [*In Japanese.*]—*Trans. nat. Hist. Soc. Taiwan* **33** no. 239 pp. 221-228, 5 figs. Taihoku, 1943.

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CONTENTS.

	PAGE
AFRICA : Migrations and Breeding of <i>Nomadacris septemfasciata</i> in 1927-45	169
AFRICA : The Status and Subspecies of <i>Dacus armatus</i> and <i>D. bivittatus</i>	176
AFRICA : Seasonal Breeding and Migrations of <i>Schistocerca gregaria</i> in western and north-western Africa	206
AFRICA, SOUTH : Biological Control of Prickly Pear in Cape Province	171
AFRICA, SOUTH : The Control of <i>Aonidiella aurantii</i> by natural Factors	172
AUSTRALIA : Pests of Vegetables and their Control in the Northern Territory	177
AUSTRALIA : Work on the Control of <i>Cydia molesta</i> in Victoria	178
AUSTRALIA : DDT and other Sprays against <i>Cydia pomonella</i>	179, 180
AUSTRALIA : <i>Aceria sheldoni</i> and its Control in New South Wales	181
AUSTRALIA : Records of <i>Teleonemia scrupulosa</i> in New South Wales	181
AUSTRALIA : The Fumigation of Wheat in Bag Stacks	181
AUSTRALIA : Insect Infestation, Temperature and Moisture in Bulk-depot Wheat	182
BRITAIN : Pests of Glasshouse Crops (<i>Review</i>)	173
BRITAIN : Observations on Bean Seed Flies in Worcestershire	173
BRITAIN : Records of alate Aphids trapped in Derbyshire	195
CANADA : Forest Insects in New Brunswick in 1945	207
EIRE : A Summary of Plant Quarantine Restrictions	184
EIRE : Insects attacking Flax in 1945	208
FORMOSA : New Hymenopterous Parasites of Lepidoptera	177
FORMOSA : A new Parasite of <i>Naranga aenescens</i> (<i>Title only</i>)	208
HOLLAND : Infestation of Turnips by <i>Helephorus</i>	190
ITALY : Parasites of <i>Quadrastripiotus perniciosus</i>	191
ITALY : The Bionomics and Control of <i>Hyalopterus arundinis</i>	191
ITALY : <i>Athalia rosae</i> on Mustard	192
ITALY : A Cecidomyiid predacious on <i>Aphis gossypii</i>	193
ITALY : The Biology, Importance and Control of <i>Prays oleellus</i>	193
ITALY : The Bionomics of <i>Cydia pomonella</i> on Walnut	194
ITALY : Scolytids in Pines on the Coast of Tuscany	195
PALESTINE : The Bionomics of <i>Emoiasca lybica</i>	175
PORTUGAL : An Invasion by Swarms of <i>Schistocerca gregaria</i>	205
SPAIN : <i>Leptinotarsa decemlineata</i> in 1945	196
SPAIN : <i>Lepidosaphes beckii</i> and <i>L. gloveri</i> on <i>Citrus</i>	196
SPAIN : The Bionomics of <i>Earias insulana</i> on Cotton	197
SPAIN : <i>Byctiscus betulae</i> on Vines	198
SPAIN : DDT against <i>Anthophonus pomorum</i> on Apple	198
SPAIN : Benzene Hexachloride in Sprays against Aphids	199
SPAIN : The Selection of efficient Strains of <i>Trichogramma minutum</i>	200
SPAIN : Experiments with Ammonium-phosphate Baits for <i>Dacus oleae</i>	201
SPAIN : The Outbreak Centres of <i>Dociostaurus maroccanus</i>	202
SPAIN : The Aphids that feed on Garden Crops	202
SPAIN : Association between <i>Pediculoides graminum</i> and a Fungus on Wheat	202
SPAIN : DDT and Benzene Hexachloride against Coleoptera on Lucerne	203
SPAIN : An Investigation of commercial Preparations of DDT and Benzene Hexachloride	204
SPAIN : The Flea-beetles that attack Crucifers	204
SPAIN : An Invasion by Swarms of <i>Schistocerca gregaria</i>	205
U.S.A. : The Influence of Cover Crops on Wireworm Injury to Tobacco	183
U.S.A. : Investigations on <i>Psallus seriatus</i> in Oklahoma	183
U.S.A. : A Revision of the White-fringed Beetle Quarantine	184
U.S.A. : Miscellaneous Pests in California in 1945	184
U.S.A. : The Introduction of Chrysomelids against <i>Hypericum</i> in California	188
U.S.A. : The Distribution of <i>Aonidiella aurantii</i> in California	188
U.S.A. : DDT in Sprays against <i>Lepidosaphes beckii</i> on <i>Citrus</i>	188
U.S.A. : Eradication of certain Pests in Los Angeles County, California	189
U.S.A. : <i>Harrisina brillians</i> on Vines in California	190
WEST INDIES : Woods resistant to <i>Kalotermes brevis</i> and Treatments against it	169
The physiological Action of Contact Insecticides	174
The Insects associated with Palms (<i>Review</i>)	177
A Review of the Pests of <i>Camellia</i>	190
The Action of DDT and Benzene Hexachloride on <i>Leptinotarsa decemlineata</i>	199
Preliminary Tests of DDT Emulsion Concentrates (<i>Title only</i>)	208
A Review of Investigations on DDT (<i>Title only</i>)	208
LEGISLATION : A Revision of the White-fringed Beetle Quarantine in U.S.A.	184
LEGISLATION : A Summary of Plant Quarantine Restrictions in Eire	184

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